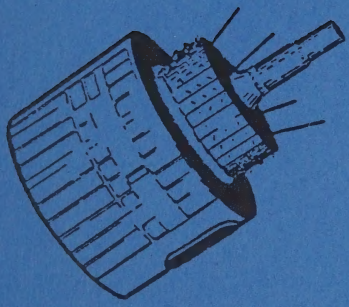
NEWSLETTER No. 14



# REMOTE IMAGING GROUP

SEPTEMBER 1988

# REMOTE IMAGING GROUP (R. I. G.)

## NEWSLETTER No. 14 SEPT 1988


| | | |
|---|---|---|
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# Editorial and Secretaries page

First of all, apologies for yet another late newsletter, problems with late submission of material and personal work commitments are the prime causes. The next one must go out on time to be with you before Christmas, where have you heard that before?

So many things have happened since the last newsletter that I may have to go into note form to get it all in.

New satellites: NOAA 11 is has now been successfully launched Russia has launched a new Meteor and one has been put up by China, Feng Yen. The European Space Agency have also launched Meteosat 3 using their very latest launch vehicle so we can confidently expect more launches from that organisation using the improved vehicle.

Weatherwatch UK has provided their first offering and I hope they will continue as the UK dissemination point for information from NOAA.
Our new stock of dishes have arrived, they are of thicker construction and are more rigid than their predecessors. The price has gone up £4. Also new stocks of horn feeds have arrived at Leighton Buzzard and I will be distributing them shortly. Finally on the stock front the postage on our downconverters and receivers has been increased, not just due to the recent increases but to actually cover the cost of packing and postage.

Many of you will note from Henry's article that I managed to take in two days of the NOAA Direct readout Users conference in Washington earlier this year. During that time I met up with many of the stalwarts of the US amateur 'remote imagers' including Greg Mengell editor of The Journal of the Environmental Satellite Amateur Users Group whose journal I receive in exchange for the RIG newsletter. I have to thank them all for the hospitality shown to me during my brief visit. One item that Greg did ask me to assist in was the location of a lost girl, I know its a longshot but please look at the 'missing person' sheet and contact me to forward any information to the USA.

And yet another plea to keep the contributions to the newsletter going, as you can see in this issue its mostly members letters but they are very informative so keep them coming.

Finally I am still sorting out fonts on the computer/printer combination so there may still be some # signs were there should be pound signs.

Phil, G8XTW

## CHAIRMAN'S WAFFLE

After the last Chairman's Report had been sent to the Editor for knocking into shape and after I had worked very hard to get in advance with my farming (a rare thing others would have you believe), very unexpectedly Henry and his better half went to Wales for a few days break. Travelling down on the Saturday afternoon and evening, we found a road-block at Porthcawl, there was no escape. We just sat there. Henry didn't say a word, except when required to, for at least an hour and a half. Miracles do happen! Well, it is all true, except there are some important gaps.

The truth is that we were very well looked after by James, Anne and their friends, and we both had a very pleasant time (if I had had more time I think we would still be talking after a week!). As we only had about five days we had to depart, but I did take care to miss the Sea Kings at Dale, and Bulch Glas does take quite a bit of finding. The moral obviously is "beware of strangers saying they've come round collecting subscriptions for the Remote Imaging Group!"

At the end of July, an article in New Scientist caught my eye. It described a recent development - a solid state blue light source. It consisted of a 840 nanometres infrared laser, which was then fed into a lithium niobate optical waveguide frequency doubler. Out comes 420 nanometres blue light , well a little, it's not very efficient at present but does stand a good chance of being optimised.

Don't get too excited, these are only laboratory specimens at present and cost about 6500 pounds! Since then I have obtained a couple of I.R. Lasers that have been rejected out of C.D. players. They come complete with a collimating lens and only cost 1 pound. I haven't done any tests with them yet but they might give enough output to mark photographic paper on a drum type machine. As usual time will tell, but I will keep you informed.

Some of you might have seen the Quad Loop Yagi on its travels this Summer at the Rally's. Yes it really does work well, even internally at the N.E.C. it gave us usable pictures. It was the first time we have had live pictures there. We also used it at Woburn, but it was so hot, I could hardly bare my hand on the downconvertor, and the system didn't give as good a result as we know it should. We also had some interference from the generator, or someone else's. Definitely a case of check the whole system out before next time.

I have received some suggestions about the Quad Loop Yagi, one was to mount it with the loops below the boom - so birds don't bend the elements. Also, don't forget to put a plug in the far end to stop the ingress of water.

Another one concerning the feed arrangement is a little difficult to describe but affects the coaxial cable. My cable eventually broke just below the boom and some thought was given to a more robust arrangement. A piece of Brass U section 1" sided but only 15mm wide was sawn off. A hole was drilled in the centre of both opposing sides. These were drilled 5mm one side and Oba clearance the other side. A 120mm length of RG141 was used. It was fitted in the proper plug / socket (Henry has found a reasonably priced source), which was then soldered to one side of the U section brass, not forgetting to slide the Oba nut onto the cable and placing it in the gap of the U section.

The U section brass is quite strong and provides a substantial mount which will even take the weight of the downconvertor. The Oba bolt is then fitted through the boom, through the Oba clearance hole in the U section and the Oba nut is then tightened up. The feed element is then fitted and soldered in place. You will need to trim the RG141 to the required length to suit the original dimensions. This is all in reverse order to the original article but does give a better mount. It has also been realised that most of the dimensions have not had the boom correction added, it's in the region of 6mm extra to all circumferences. This is quiet small so you need not worry, it just means that the device covers 1670 to 1800 MHz with the figures given, instead of having 1700 MHz in the middle.

The article by James Brown describing his F.M. tape recording system gave me an idea. Would it be possible to record the clock pulses for the Russian Satellites on the same track? Remember that the 2400 carrier is converted to a F.M. audio signal at the high audio frequencies of about 9000 to 12000 hertz. After the new high frequencies have been generated could a 2400 clock signal be added at low level say 10% to the input channel to the tape recorder? Both signals would be recorded together. On replay, the 2400 hertz could be filtered out via a bandpass filter and the wideband F.M. part via a highpass circuit to the discriminator to reconstitute the original signal. Perhaps it is easier to use a twin track or stereo machine in the first place.

Newsletter no.13 arrived in the end, and was the thickest one so far, even our printer had to buy heavier duty staplers to hold it together. Similarly with our group, it is a job to visualise what we are going to do next, but there is always some development work or information to pass on to our members. I'm sure you will agree that the pictures were better in the last newsletter but they were much more expensive and had to be done by another printer and as usual this delayed things even further.

During 1988 we have had the A.G.M. at Sandown, we attended the B.A.T.C. rally at Crick, the Elvaston Castle rally, the N.E.C. Exhibition at Birmingham and then the National R.S.G.B. rally at Woburn. I think that we can now settle down to a much quieter remainder of the year and fewer early morning starts, contented that we have had a very successful rally season. Membership is now over the 1000 mark again and who knows what the year end total will be? With all this travelling and driving, I must confess that there are times when I get very tired and my driving is not 100% of what it should be.

When I arrive home safely I sit down and realise that as someone somewhere once said "You are only dead once!" you must be extra careful and not have anything untoward happen, somethings are rectifiable others are terminal! (no it wasn't the Bishop to the actress). It doesn't always happen to someone else, it can happen to you. I've had my fair share of narrow escapes, and experience sometimes makes you wiser and more careful, but the chances still get stacked up further and further against you, so be extra careful we need all our R.I.G. members!

By the way, did you see that marvellous demonstration that Peter Newman put on at the N.E.C. on the Saturday and Sunday? It was an Atari ST with 1Mbyte. There are up to 15 images stored at 320 X 200 by 16 levels, contact Peter for further details. The results were remarkable and really took a fair bit of absorbing.

I was given something for nothing just recently. I didn't want it but none the less I was given it. It was left near the roadside just hidden in my crop of wheat. It gave my poor old combine harvester a severe case of indigestion. It was a worn out tyre. The donor might be pleased to learn that it took four hours to get the unfortunate victim to pass the same, but the patient is now fully recovered. So I would like to thank the donor very much, personally, but I think they would prefer to remain anonymous. By the time you read this, I shall have seen an awful lot of Giga Megajoules go up to their maker, initiated by just one England's Glory. One day there will be an alternative, but until that day comes there really just isn't anything else you can do with it all. I really have thought hard many times about it, but to no avail. To some extent it grieves me to think of all that energy being wasted and then having to buy fuel for the central heating to keep the home warm for the rest of the year. If I could find a solution I would earn a bob or two, but there isn't anything that fits the bill on the timescale required, you just cannot hang about!

In the last Chairman's report I told you about Colin Hall going to the 1988 NOAA Direct Users Conference in America, well at the last

moment Phil also managed two days there, combined with a business trip, so R.I.G. was well represented, reports and comments will be forthcoming (some people have all the luck!).

I must resolve not to buy anymore transparent handled screwdrivers of any type. I already have five but can hardly ever find them in my toolbox. They blend in with the rest of the tools and I can never find one when required. I suppose I could dip them in some brightly coloured paint so they are more readily visible, but it wouldn't be the same, I wouldn't be able to blame my son for borrowing them then!

Now for all R.I.G. Amiga computer owners, James Brown from Porthcawl also has one, but so also do about ten other members according to our records. James is willing to form a subgroup and be a communication point. At present he is not able to process Weather Pictures on his own machine but there is every possibility he will in the near future. I believe that Bob Buttery is already doing so at 16 grey levels but hopes to increase this shortly. So watch out for more details, contact Phil for further details.

Meteosat 3 is now in action as you can see from the centre pictures from Les Currington. But I gather that there is a problem with the signal, according to one source the signal drops in strength 100 times a minute, but according to another it drops about 4.5db twice a line. In both cases you will not notice any problem if you are getting a very strong signal. Normally the spacecraft's transmitter is fed to one of the many aerials around the periphery of the spacecraft. As the spacecraft is spinning at 100 R.P.M. the aerial nearest the earth is connected to the transmitter in sequence to give maximum signal where it is required, just like a very big rotary coaxial switch with many outlets, only it probably uses PIN switching diodes. Well possibly some of the PIN diodes are not working or something else in the chain is not as it should be and the end result is that there are short periods when the signal is not as strong as it should be. These drops are in the region of 4 or 5 db.

If you are receiving a very strong signal you possibly won't even notice the difference, but if the signal is only normally just strong enough you will be hearing the decreased signal to noise during these weaker signal periods. Work is obviously being done at present because when I first heard it there were 3 periods of weak signal per revolution (0.6seconds). At present there are only two, each are approx. 60 milliseconds long and separated by about 240 milliseconds. Now it's back to 3. Lets hope this problem can be sorted out soon otherwise we shall all have to get bigger dishes (I don't think the Quad Loop Yagi will go to 18 feet).

And finally as they say, news of a Chinese spacecraft which has just been launched giving two visible images like the NOAA's but the subcarrier is not locked for timing purposes. You will have to use home generated timing from your 2400 Hz source. Kepler elements will be included in the Late News if they are not in the usual place and if they are available. 137.04 Mhz approx. is the frequency to listen and the overhead crossing time is in the region of 1510 BST.

In the meantime let's hope Meteosat 3 gets better and Newsletter no.14 is not too long overdue by the time it reaches you.

Best wishes
Henry

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# A Peasant's Eye of Kepler Elements.

If you're a satellite enthusiast, rather than an out and out satellite freak, you'll probably be aware that there are other things in life to be done than just hanging around waiting for satellites to appear, and so, there's a need for some form of orbit predictions. If you are state-of-the-art, your PC and its slick software will accept direct input of the Kepler elements, and all the necessary will appear before your eyes.

Unfortunately, despite faithfully sending off Readers Digest Prize Draw 'NO' envelopes for many years, I haven't yet won the 50,000 pounds, and so I'm still without my IBM, and forced to adopt a more rough and ready method of using the Kepler Elements for orbiting predictions.

All that's needed is a scientific calculator and a bit of time. Here goes with an explanation of Peasant Bailey's method; I'm really glad Mr. Kepler will not be seeing it. The following at least usually appear in a set of Kepler Elements: Epoch year, day and fraction of day; drag factor; inclination; right ascension of the ascending node; eccentricity; argument of perigee; mean anomaly; mean motion; revolution ( orbit) number.

Here's a typical element set for NOAA-10:

| | | | |
|---|---|---|---|
| Epoch of data: | 88161.21474610 | Drag: | 0.00000245 |
| Inclination: | 98.6749 | Right Ascension: | 192.1012 |
| Eccentricity: | 0.0012596 | Argument of perigee: | 250.3113 |
| Mean Anomaly: | 109.6739 | Mean Motion: | 14.22582018 |
| Rev: | 8964 | | |

For our humble purposes, we can ignore the figures for drag, mean anomaly, and argument of perigee. The daily change in argument of perigee is in fact important, however, and will be calculated.

The first thing to work out is the date and time at which the Kepler data is valid. This is the Epoch of data.

From NOAA 10 above:
88161.21474610. 88 means simply 1988, and 161 indicates the 161st day of the year. Since 1988 is a leap year, day 161 is the 9th of June. For me, the simplest way to determine the date is just to note on a calendar the day of the year for the last day in each month; thus the 31st of May is day 152 in a leap year, so: 161-152=9th of June. The rest of the group ( .21474610 ) is the Epoch fraction of day.

There being 1440 minutes in a day, we can determine the time very simply:

1440 x 0.21474610 = 309.234384 minutes since the start of the day, i.e. midnight.

There's no point in being that precise with the Bailey method, so the figures after the decimal point decently ( indecently, really ) ignored:

309/60 = 5 hours; 5 x 60 = 300; 309 - 300 = 9 minutes.

The date and time for the moment at which our Kepler data is valid is the 9th June 1988 at 0509 GMT, or, if you really must 0509 UTC.

One of the things we want to know is the point on the equator where the satellite makes its north bound crossing - the Ascending Node. This point is usually measured in degrees west of Greenwich Meridian, 000 degrees longitude. A satellite crossing the Equator at longitude 10 degrees east would therefore have an ascending node of 350 degrees west. We have to derive this figure from the Kepler element known as the "Right Ascension of the Ascending Node" (RAAN) with this element, the ascending node is measured in degrees east of what is known as the First Point of Aires; this is a fixed point referenced to the stars. The Earth is of course rotating against the reference frame of the stars, and so the angle between the First Point of Aires and the Greenwich Meridian is changing moment by moment.

If we want to know the ascending node in degrees west of Greenwich, we'll have to find out first of all the angle between the first Point of Aires and Greenwich at Epoch. This is known as the Greenwich Hour Angle of the First Point of Aires, which I'll abbreviate to GHA. It should be GHA squiggle, the squiggle representing the horns of the Ram, but my writing machine does not have a suitable squiggle, so that's that. Anyway using the following formula, we can determine the GHA with an accuracy quite good enough.

GHA = 99.5 + ( 360 x fraction of day ) + ( 0.986 x day of year ).

Then the ascending node in degrees west of Greenwich is simply:

(GHA - RAAN).

If the answer is less than 0 or greater than 360, then just add or subtract 360 to bring the figure into range.

Using the NOAA -10 data given above:

GHA = 99.5 + (360 x 0.21474610 ) + ( 0.986 x 161 ) + 335.554596

Not wasting any of our time with anything after the decimal point, the ascending node figure will be:

335.5 - 192.1 = 143 degrees west.

The next item to work out is the nodal period of the satellite, the time it takes to go from one north bound equator crossing to the following one, i.e. once around the world.

The Kepler element Mean Motion gives the number of orbits made by the satellite in one day, so it would appear easy to deduce the period from:

( 1440 / mean motion ).

Unfortunately, this isn't the case. The Mean Motion is the orbit count in a day ( 1440 minutes ), from perigee to perigee. As you probably know, the perigee is the point on the orbit when the satellite is closest to the earth. The argument of perigee is simply the angle between two lines, starting at the centre of the earth, taken to the perigee, and to the equator, the point on the equator being at the ascending node.

Due to the earth's bulge around the equator, the argument of perigee doesn't remain constant, but undergoes a change of up to 3 degrees per day for the average weather satellite, and this is the reason dividing 1440 by the Mean Motion doesn't give us the nodal period.

It's close, but unfortunately, not close enough. The following method will produce a figure for the nodal period that will be accurate to at least three decimal places-that'll do nicely.

The first step is to get a figure for the semi major axis of the orbital ellipse, designated "a".

$$a = 331.25 \times \left( \frac{1440}{mm} \right)^{2/3} \text{ kilometres.}$$

where mm = Mean Motion.

Using NOAA-10 data, a = 7194.4997 km.

Next, we can work out the daily change into argument of perigee (dw ).
The formula may appear a bit daunting, but with a scientific calculator and a bit of care, it's easy. I bought a programmable calculator for fourteen pounds at the local Dixons, and it takes only about 10 seconds to get an answer for dw with the program in memory.

$$dw = 4.97 \times \left( \frac{Req}{a} \right)^{3.5} \times \frac{2}{(5 \cos^2 i - 1)} \over (1 - e^2)$$

Req = mean equatorial radius of the earth = 6378km
a = semi-major axis in km.
e = eccentricity.
i = inclination in degrees.

Using the calculated value for a, and values for e and i from the Kepler data, dw in our example comes out to 2.88941 degrees.

Note it's a negative number.

One more calculation to go, and we get the answer for the Nodal Period, NP.

$$NP = 1440 \times \frac{360 \times mm}{(360 \times mm) + dw}$$
$$mm$$

Putting in the relevant values, and not forgetting dw is negative,

NP = 101.281 minutes.

Only one more item to work out, and we have a set of parameters that will define an orbit with terrestial references, that we can use to predict with certainty the future appearances of the satellite in question.

We need to know the increments between orbits (I), that is the number of degrees longitude between successive ascending nodes. They will appear to move westwards, of course, since the earth moves westwardly.

Although in simple terms the plane of the satellites orbit remains fixed in space, with the earth rotating beneath it, it does in fact precess around the earth's north-south axis, again due to the equatorial bulge.

What we do is obtain the first theoretical value for I, calculate the precession, and then use this to get a corrected figure for I.

Theoretical Increment between orbits (tI) = 0.250684 x NP degrees.

Using our example,

tI = 0.250684 x 101.281 = 25.3895262 degrees.

The precession in degrees per day (p) is given by:

$$p = 9.95 \left( \frac{Req}{a} \right)^{3.5} \times \cos i$$

Using the values we already have, p = - 0.98446

The true increment (I) can now be worked out by:

$$I = \frac{P}{1440/NP} + tI$$

In our case, then, I = 25.32 degrees.

So, that's it. Listing the results:

NOAA 10

0509 GMT, 9TH JUNE 1988

Ascending Node 143 degrees west

Nodal period 101.281 minutes

Increments between orbits 25.32 degrees.

This reference orbit is good enough to keep track of the satellite for some weeks; I usually update about once a month.

Well, that's my system of fiddling the Kepler elements to do a useful job, and I've managed to keep tabs on all the various weather sats. over the years. Some day, I'll have the time to swot up on the subject properly.....and elevate myself from the peasantry!

David Bailey

# COMPUTER CONTROL OF RIG RECEIVER.

Since obtaining one of these excellent receivers, I have had random thoughts on controlling it from a computer, so if you try what follows, be it on your own head, as it has yet to be fully proved !!!.

The receiver works out the frequency from the information in the EPROM, this is put as a series of high or lows on the data lines, pins 9, 10, 11, 13, 14, 15, 16, and 17, and is then turned into an appropriate frequency by the synthesiser chip.
The Eprom can also be made to "appear" by putting a low on pins 18 and 20, and to "disappear" by putting a high on them.

In order for the computer to read data from the Eprom or to send data to the receiver a 74LS245 (bi-directional buffer IC) would be needed, this chip can be made to pass data in the required direction, by putting an appropriate signal on pin 1, from the computer.

One further connection is required and that is to sense when the squelch is open, this signal is available from pin 10 of the 4011 IC, this is logic high when squelch closed and low when open.

So assuming you have a computer with a user port which can support 8 data lines and 2 signal lines, then you can go computer controlled, by building a small interface board.

Logics. See circuit diagram 1.

PIN 1 WITH A LOW

Allows signals to pass from B to A and makes the EPROM appear as normal.

This will allow you to let the receiver do its normal scan, and your program can work out what frequency and time a satellite is received, by sensing when the squelch is open.

PIN 1 WITH A HIGH.

Allows signals to pass from A to B and makes the EPROM disappear.

You can now send data to the receiver and make your program scan what frequencies you want, using the tape recorder to collect only those passes needed.

If there is a lot of interest in this, I may well come up with a PCB and more information, suitable computers would be VIC 20 (available at rallies very cheaply), CBM 64/128, BBC, etc.

The above is just an idea to get you going, there are many more things you could with a very simple program.

Since writing the above, and due to the postal strike I can now add more information.

If you try what follows, and have a disaster, claims will not be entertained.

I have now tried out part of the theory of the control system, without using the 74LS245 chip, possibly an unwise move, so extra care with the connections was taken.

To make sure that no nasties happened, I removed the Eprom from the receiver, made up a plug in connector to the socket, and connected the 8 data lines to the user port on my trusty old CBM PET, (See circuit 2) the squelch line was connected to the diagnostic line on the same port.

On powering up both units, all appeared ok, as there was no smoke or flames.

You have to set the 8 data lines on the user port for output, for transmitting numbers to the receiver, the diagnostic line being automatically set up by the operating system as an input, and allows reading the line which will reflect the state of the signal when the squelch opens.

Looking at the 6522 chip data sheet, the data direction register has to be loaded with 255, to make the 8 lines of the port outputs.

Looking at the memory map of the computer I came up with the following:-

| | |
|---|---|
| DIRECTION REGISTER | 59459 |
| DIAGNOSTIC LINE | 59408 BIT 7 |
| PORT | 59471 |

Translation of number to frequency:.

| Number sent | Frequency resulting |
|---|---|
| 0 | 136.14 |
| 1 | 136.15 |
| 2 | 136.16 |
| Etc. to 191 | 138.05 |
| 192 | 135.50 |
| 193 | 135.51 |
| 194 | 135.52 |
| Etc. to 255 | 136.13 |

So lowest available frequency is 135.50, highest is 138.05

The test programme is written in CBM basic, you should have little difficulty translating it to any other Basic. It is just a test, has few niceties and was written on the 'fly' so no complaints on its structure, it works.

```
1000 PRINT "     SATELLITE LOGGING BY COMPUTER":PRINT""
1100 DATA 116,137.30,126,137.40,136,137.50
1200 DATA 148,137.62,156,137.70,171,137.85,999,999
1300 POKE 59459,255
1400 REM
1500 READ A,B$:IF A=999 THEN RESTORE:GOTO 1500
1600 POKE 59471,A
1700 FOR I=1 TO 100:NEXT
1800 FOR I=1 TO 200
1900 IF 128 AND (NOT(PEEK(59408))) THEN 2200
2000 NEXT
2100 GOTO 1500
2200 FOR I=1 TO 300
2300 IF PEEK (59408) AND 128 THEN 1800
2400 NEXT
2500 PRINT "SATELLITE RXD   "B$" AT "TI$
2600 IF PEEK (59408) AND 128 THEN 2800
2700 GOTO 2600
2800 FOR Z=1 TO 2500      : REM ALLOW UPTO 30 SECS DROPOUT
2900 IF 128 AND (NOT(PEEK(59408))) THEN I=2500
3000 NEXT
3100 IF 128 AND (NOT(PEEK(59408))) THEN 2600
3200 IF PEEK (59408) AND 128 THEN 3400
3300 GOTO 2600
3400 PRINT "SATELLITE LOST  "B$" AT "TI$:PRINT"":GOTO 1400
```

NOTES
TI$ is CBM variable for time, some computers use TIME$

The loop at line 1700 is to let the data settle and the receiver to stabilise on frequency.

Line 2200 prevents false logging of short bursts of interference up to 2 secs or so in length.

Line 2900 resets the count down if the squelch re-opens whilst it is waiting the 30 secs before moving from the frequency.

Changes for VIC 20. APPEARS TO WORK OK

Line 1300 to read POKE 37138,255: POKE 37139,0
Line 1600 to read POKE 37136,A

Change 128 and 59408 on lines 1900, 2300, 2600, 2900, 3100, 3200 to 8 and 37137

Changes for CBM 64, APPEARS TO WORK BUT -

WARNING

POSSIBLE PROBLEMS OF FREQUENCY INSTABILITY DUE PERHAPS TO NEED FOR PULL-UPS ON DATA LINES, SO BEWARE, I BELIEVE THE 6526 CHIPS ARE NOT AS ROBUST AS THE 6522 IN THE VIC AND PET, OR MY 64 IS A BIT SICK !

Line 1300 to read POKE 56579,255 : POKE 56578,(PEEK(56578) AND NOT 4)

Line 1600 to read POKE 56577,A

Change 128 and 59408 on lines 1900, 2300, 2600, 2900, 3100, 3200 to 4 and 56578

Move wire on PIN 5 of user port to PIN M

For the experienced experimenters you could follow my test ideas, for the non-experienced, perhaps you should wait until I come up with a PCB interface board, and more testing has been done.

COMPUTER NOISE/RF

I was very surprised that there was not a great deal of signal deterioration due to RF from the computer, bearing in mind that my receiver is still not boxed, and the cable used was ribbon cable with no screening whatsoever, more details hopefully next issue.

On the next page there is a sample of a days logging,

Bob Leggett G6KMM.

SATELLITE LOGGING BY COMPUTER SUNDAY/MONDAY 11/12 SEPT.

ALL SIGNALS RECEIVED ON CROSSED DIPOLES, YOU CAN SEE WHICH ONES ARE CLOSE TO THE HORIZON, BY BEING UP TO 4 ENTRIES FOR THE SATELLITE

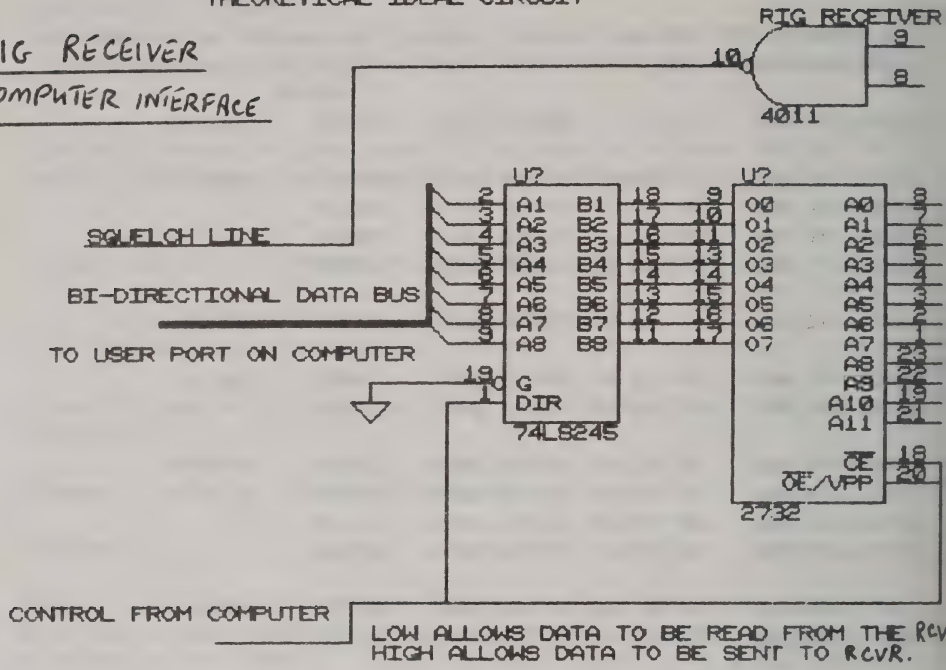
| | | | | | |
|---|---|---|---|---|---|
| SATELLITE RXD | 137.40 | AT | 092059 | UNTIL 092453 | RUSSIAN |
| SATELLITE RXD | 137.50 | AT | 095254 | UNTIL 095752 | NOAA 10 |
| SATELLITE RXD | 137.50 | AT | 095835 | UNTIL 100328 | |
| SATELLITE RXD | 137.50 | AT | 100350 | UNTIL 100445 | |
| SATELLITE RXD | 137.50 | AT | 100507 | UNTIL 100554 | |
| SATELLITE RXD | 137.30 | AT | 102219 | UNTIL 103348 | RUSSIAN |
| SATELLITE RXD | 137.62 | AT | 114423 | UNTIL 114508 | NOAA 9 |
| SATELLITE RXD | 137.62 | AT | 114616 | UNTIL 114756 | |
| SATELLITE RXD | 137.30 | AT | 120419 | UNTIL 120506 | RUSSIAN |
| SATELLITE RXD | 137.30 | AT | 120712 | UNTIL 121249 | |
| SATELLITE RXD | 137.30 | AT | 121336 | UNTIL 121423 | |
| SATELLITE RXD | 137.30 | AT | 121758 | UNTIL 121846 | |
| SATELLITE RXD | 137.62 | AT | 132224 | UNTIL 132318 | NOAA 9 |
| SATELLITE RXD | 137.62 | AT | 132341 | UNTIL 132957 | |
| SATELLITE RXD | 137.40 | AT | 144926 | UNTIL 145209 | RUSSIAN |
| SATELLITE RXD | 137.40 | AT | 145248 | UNTIL 145536 | |
| SATELLITE RXD | 137.62 | AT | 150037 | UNTIL 151035 | NOAA 9 |
| SATELLITE RXD | 137.50 | AT | 162525 | UNTIL 162836 | NOAA 10 |
| SATELLITE RXD | 137.50 | AT | 162858 | UNTIL 163119 | |
| SATELLITE RXD | 137.40 | AT | 163508 | UNTIL 164438 | RUSSIAN |
| SATELLITE RXD | 137.62 | AT | 164447 | UNTIL 164741 | |
| SATELLITE RXD | 137.50 | AT | 180226 | UNTIL 181053 | NOAA 9 |
| SATELLITE RXD | 137.50 | AT | 181115 | UNTIL 181231 | |
| SATELLITE RXD | 137.40 | AT | 182227 | UNTIL 182320 | RUSSIAN |
| SATELLITE RXD | 137.40 | AT | 182343 | UNTIL 182910 | |
| SATELLITE RXD | 137.40 | AT | 182932 | UNTIL 183047 | |
| SATELLITE RXD | 137.50 | AT | 194130 | UNTIL 194937 | NOAA 10 |
| SATELLITE RXD | 137.50 | AT | 074808 | UNTIL 080014 | NOAA 10 |

All times are GMT, and no I wasn't up watching pictures all night !

THEORETICAL IDEAL CIRCUIT

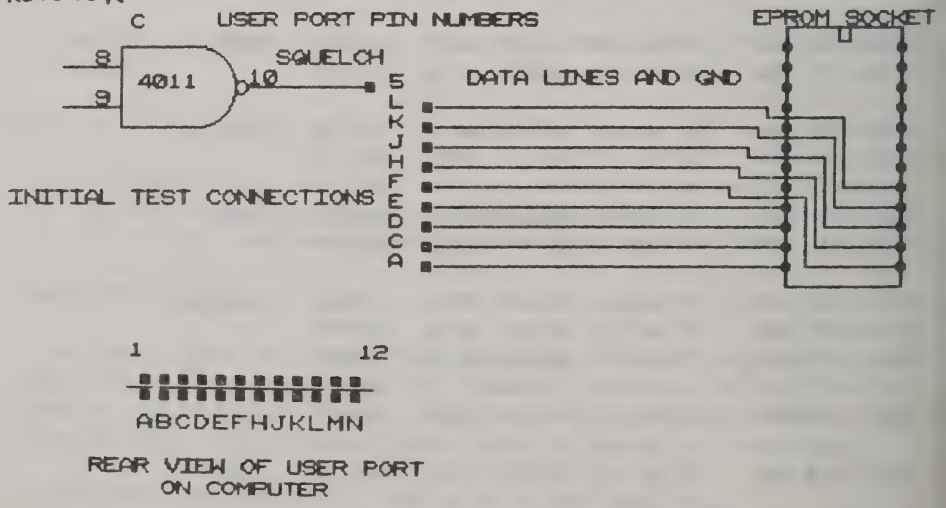
RIG RECEIVER

COMPUTER INTERFACE




RIG RECEIVER

INITIAL TEST CIRCUIT



## RUSSIAN SATELLITE CORNER by Les Currington
### Activity as at 23rd August 1988.

Meteor 30 80-51 137.15 MHz drifting to 136.96 MHz

After eight years of nearly continuous transmissions Met 30 was switched off on its eighth birthday. The 11.30 GMT pass on 18.6.88 was recorded ready for printing at a later date and will add to the collection of prints taken when the old bird was in her prime.

Cosmos 1602 84-105A 137.33 MHz

For several months 1602 has been reported by several observers to be transmitting visible pictures intermittently. James Brown in the last issue of Rig reported more consistent signals were being received and the quality was quite good. However on about the second week in May transmissions were on continuously and appeared to be out of control; the on board clock was showing incorrect time and varying from day to day.
By the 17th May the picture quality was very poor and completely out of focus. After several days transmissions ceased and nothing more has been heard or reported by other observers.

OKEAN 1988 - 56A 137.4 MHz

At 11.40 GMT on the 6th July 1988 an excellent visible picture was received by James Brown; after identification by Geoff Perry it was found to be a new oceanographic Satellite.
Excellent Radar pictures were received over a period between 9.7.88 and 14.7.88; on the 15.7.88 at 19.21GMT Radar- Visible- M/Scanner pictures were transmitted, these were of a quality which far exceeded the previous oceanographic series.
Adrian Buchan of Brixham reported a recorded picture taken near Japan and dumped when on a pass over Scandinavia.
The data format is APT and a line rate of 4 lines per second. Telemetry is similar to the previous Cosmos 1766 and appears as a series of number and grey scale along the edge of the frame. Also the usual piano key format when transmitting Radar only.
Since 21.7.88 no further signals have been received by myself but may be we have had a brief glimpse of what would have been a superb satellite.

The following extract taken from the Aerospace Daily will be of great interest:-

An oceanographic satellite launched this week by the Soviet Union was said yesterday by observers to be a replacement for for one that had difficulties last year.

The new satellite follows Cosmos 1869, which was launched July 16, 1987. An antenna of 1869's 12-meter-long side looking radar failed to deploy, and the Soviets said a replacement satellite would be launched in early 88.

Geoffrey Perry of the Kettering Group in England said the new satellite, which was launched July 5th is about 6 months later than expected, and that it is the first of a series to bear the code name "Okean" (Ocean).

Nicholas L. Johnson of Teledyne Brown Engineering in Colorado Springs, Colo., said the Soviets have informally used the Okean name for the last few years, Perry said the Soviets have acknowledged a series of satellites to be working under the "Resus" (Resources) system under the name "Okean-O", where "O" stands for optical. The series began in 1983 with Cosmos 1500. Other satellites in the series, besides Cosmos 1869, were Cosmos 1602 and 1766.

Perry said that a member of the U.K. Remote Imaging Group, Rev James Brown of Porthcawl, Wales, reported signals from Okean at 11:40 GMT July 6th. Perry said it " has the same telemetry format as it's predecessors," but that an on board clock that records time down the side of images intended for Russian ground stations was off by eight hours and 50 minutes. It was expected to be corrected by Soviet controllers in a day or two.
"Picture quality was very good on a pass which took (Okean) from Gibraltar northwards to Belgium, when the transmission was switched off at 11:48 (GMT)" Perry said.

The news agency Tass said Okean was launched by a Tsiklon (Cyclone) booster and that it went into an orbit with the following parameters: inclination 82.5 degrees, apogee 680 Kilometres, perigee 651 km and period 97.8 minutes. The main purpose of the launching is to receive oceanographic information and data on ice conditions.....Tass said".

Meteor 3-02 1988-64A 137.3 MHz

Just as we were wondering what had happened to Okean a new signal format was received on 137.3 mHz at 15.48 GMT on 27.7.88; consisting off 9 phasing bars followed by a wide black bar, after several minutes this was followed by a visible picture of very poor quality. At 17.38 GMT signals were received followed by the same format; at maximum signal strength the transmission suddenly ceased.
Geoff Perry immediately came up with the answer: a launch of a new Meteor in a 82.5 degree inclination and 13.6 mean motion orbit this could be none other than a new Meteor 3 series.

Excitement was raised knowing the extended coverage given by the previous Meteor 3-01, but alas excitement was short lived as after that no more signals were received.

Meteor 2-15 1987-1A 137.85 MHz

Lawrence Harris reported loss of signals from this satellite during early August and nothing has been heard of this Meteor after that period.

Meteor 2-16 1987-68A 137.4 MHz

Meteor 2-16 is now giving reasonable pictures in an early morning ascending pass but will soon be suffering from lack of solar energy to give early morning pictures. The descending late afternoon pass should soon be giving good pictures.

Meteor 2-17 1988- 05A 137.3 MHz
Meteor 2-17 continues to function normally and is now in a midday pass. Peter Waklin on Ascension Island reported edge code sticking at tcu until solar elevation drops to approx 50 degrees during late June.

Mercury Interference

Several months ago I complained about the severe interference caused by a Mercury Relay station near my home. For at least nine months it has been impossible to receive a pass without getting interference blotting out the picture. On returning home from my holiday in May I was surprised to find that the interference had been greatly reduced and most passes could be obtained without loss of picture. I hope other sufferers are now experiencing a similar reduction in interference. Maybe our earlier complaints regarding these data relay stations have bought results.

Having cleared one interference problem another has occurred. For 5 seconds in every minute on a NOAA pass the signal strength meter dips and a weak pattern of interference shows up on the picture.
The frequency around 137MHz has been checked and no signal has been found. Has any member experienced this signal and where does it radiate from?

Les.

## Late News from Les Currington:

OKEAN
Reports have been received that this satellite has commenced transmissions again.
Pictures have been received by John Murray of Brixham, James Brown and myself at 14.05 GMT on 19 Sept 1988.

Meteor 3-02 1988-64 A 137.85 MHz
Meteor 3-02 resumed transmissions on Monday 12 Sept 1988. Excellent pictures were received by James Brown, Terry Weatherley and Peter Wakelin.
James Brown received Infra Red during the evening of 16 Sept 1988 confirming the picture received by myself on 27 July as Infra Red.
Frequency has moved from 137.3 MHz to 137.85 MHz.

New Chinese Satellite 1988 - 80 A
At 2030 GMT on 13 Sept 1988 China launched a weather satellite.
Transmissions were received on the 19 Sept 1988 at 11.40, 13.22 and 15.00 GMT of excellent quality.

Frequency was 137.79 or 137.8 Mhz - not sure
Period 103 minutes
Sun Synchronous
Five Spectral channels
Similar side-by-side format to NOAA series

On 11 Sept 1988 Ascending node transmissions were switched off over Europe.
Technical details given by Geoff Perry
Kepler data obtained from Max White
LOK Sync board gave positive selection visible and IR channels.

KEPLER ELEMENTS provided by Max White
ROYAL GREENWICH OBSERVATORY, HERSTMONCEAUX CASTLE

| | MET 3-1<br>137.85 MHz<br>85-100 A | MET 2-17<br>137.30 MHz<br>88-05 A | MET 30<br>136.97 MHz<br>80-51 A |
|---|---|---|---|
| EPOCH OF DATA | 88261.90289919 | 88262.00252103 | 88270.29346997 |
| ACCELERATION | 0.00000043 | 0.00000116 | 0.00006393 |
| REV NO | 7774 | 569 | 6080 |
| INCLINATION | 82.5419 | 82.5456 | 97.7098 |
| R. A. NODE | 68.2670 | 136.8482 | 358.4900 |
| ECCENTRICITY | 0.0018827 | 0.0016451 | 0.0039195 |
| ARG OF PERIGEE | 260.0829 | 317.7170 | 30.6187 |
| MEAN ANOMALY | 99.8174 | 42.2725 | 329.7322 |
| MEAN MOTION | 13.19933476 | 13.84041601 | 15.00309342 |
| SEMI MAJOR AXIS | | | |

| | COSMOS 1766<br>137.4 MHz<br>86-55 A | NOAA 11<br>137.62 MHz<br>88-89 A | NOAA 10<br>137.50 MHz<br>86-73 A |
|---|---|---|---|
| EPOCH OF DATA | 88269.46243673 | 88270.23685619 | 88265.23780660 |
| ACCELERATION | 0.00001144 | 0.00025529 | 0.00000215 |
| REV NO | 11628 | 74 | 1590 |
| INCLINATION | 82.5194 | 98.9127 | 98.6736 |
| R. A. NODE | 282.3488 | 210.0192 | 294.5114 |
| ECCENTRICITY | 0.0022101 | 0.0010014 | 0.0013361 |
| ARG OF PERIGEE | 238.4611 | 258.5851 | 314.9155 |
| MEAN ANOMALY | 121.4509 | 101.4013 | 45.0936 |
| MEAN MOTION | 14.73852191 | 14.10630339 | 14.22629414 |
| SEMI MAJOR AXIS | | | |

| | MET 2-15<br>137.85 MHz<br>87-1 A | MET 2-16<br>137.4 MHz<br>87-68 A | COSMOS 1869<br>137.4 MHz<br>87-62 A |
|---|---|---|---|
| EPOCH OF DATA | 88261.97118155 | 88268.97782709 | 88269.22427583 |
| ACCELERATION | 0.00000077 | -0.00000206 | 0.00001631 |
| REV NO | 1892 | 1485 | 6435 |
| INCLINATION | 82.4655 | 82.5575 | 82.5218 |
| R. A. NODE | 12.0891 | 69.6655 | 343.4130 |
| ECCENTRICITY | 0.0012788 | 0.0012331 | 0.0023081 |
| ARG OF PERIGEE | 308.3565 | 213.8412 | 313.9037 |
| MEAN ANOMALY | 51.6501 | 146.2039 | 46.0340 |
| MEAN MOTION | 13.83603795 | 13.83357453 | 14.73730349 |
| SEMI MAJOR AXIS | | | |

| | OKEAN<br>137.4 MHz<br>88-56 A | MET 3-02<br>137.3 MHz<br>88-64 A | FENG YUN<br>137.04 MHz<br>88-80 A |
|---|---|---|---|
| EPOCH OF DATA | 88269.71119876 | 88268.06838662 | 88265.83490458 |
| ACCELERATION | -0.00012491 | 0.00000391 | 0.00000250 |
| REV NO | 1015 | 351 | 158 |
| INCLINATION | 82.5214 | 82.5460 | 99.1293 |
| R. A. NODE | 20.7869 | 3.8941 | 234.1276 |
| ECCENTRICITY | 0.0023594 | 0.0016680 | 0.0016206 |
| ARG OF PERIGEE | 14.4997 | 119.0633 | 2.6389 |
| MEAN ANOMALY | 345.7024 | 241.2142 | 357.0781 |
| MEAN MOTION | 14.73360535 | 13.16842583 | 14.00343671 |
| SEMI MAJOR AXIS | | | |

| | COSMOS 1602<br>137.33 MHz<br>84-105 A |
|---|---|
| EPOCH OF DATA | 88270.29258181 |
| ACCELERATION | 0.00001533 |
| REV NO | 9161 |
| INCLINATION | 82.5376 |
| R. A. NODE | 221.6917 |
| ECCENTRICITY | 0.0023548 |
| ARG OF PERIGEE | 219.4235 |
| MEAN ANOMALY | 140.5298 |
| MEAN MOTION | 14.74023421 |
| SEMI MAJOR AXIS | |

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Notes on Feng Yun satellite:

Its operating frequencies have been observed as 137.035 & 137.795MHz

It is very similar to the NOAA series of satellites

Feng Yen means 'Wind & Clouds'.

Frame store users will need the internal 2400Hz clock to stop picture leaning

## METEOSAT UP DATE

On August the 11th 1988 all missions were transferred from METEOSAT -P2. From August the 15th PDUS Image Data containing valid calibration data and meteorological products were once more derived and distributed on the GTS.

METEOSAT-P2. is now to be known as METEOSAT-3 and will be the primary satellite until mop-1 is launched (currently planned for January 1989 on ARIANE 4 launch V29)

The aged METEOSAT-2 will in due course be drifted to about 10 degrees West and will act as back up until MOP-1 takes over the mission.

Once MOP-1 is satisfactorily checked out, METEOSAT will be ejected from geostationary orbit.

IMAGE DISSEMINATION FROM THE MOP SERIES OF SATELLITES.

The METEOSAT image dissemination service is presently performed using two dedicated S-band channels at 1691 MHz and 1694.5 MHz.

either channel can support:

- analogue WEFAX transmissions compatible with APT standard

- Digital transmissions using a specific METEOSAT data format for users requiring data in a form suitable for local computer processing.

At present, Channel 1 (1694.5 MHz) is used for WEFAX transmissions whilst Channel 2 (1691 MHz) is used for both digital and analogue transmissions (including GOES image relay transmissions).

Following the launch of MOP-1 (and subsequent MOP satellite), the analogue WEFAX transmissions will be transferred to 1691 MHz to conform with similar transmissions from other geostationary meteorological satellites.

Users who are receiving only WEFAX transmissions at present on 1694.5 mHz will therefore have to change to 1691 MHz when MOP-1 becomes a primary satellite.

NOTIFICATION OF USER STATION PERFORMANCE

Users of the METEOSAT system are advised that the transmitted power

of the MOP series of satellites will be slightly different when compared with that of METEOSAT 1,2 and P2.
This small change in performance of the RF link is a result of of the addition of one further satellite mission, The Meteorological Data Distribution (MDD) mission, which will share the available power of one of the satellite transponder amplifiers used for image dissemination.

There is, however, no change in the original SDUS and PDUS RF link specification.

It may be recalled that the specification of the link to PDUS and SDUS calls for RF front end figure of merit as follows:-

| | PDUS | SDUS |
|---|---|---|
| G/T | + 10.5 DB/K | +2.5 DB/K |

Provided that user ground stations are manufactured this original specified performance, there will be no degradation of reception quality from the MOP satellites.

The METEOSAT dissemination schedule dated 01 August 1987 is still valid and is available from Weatherwatch. at the following address:

Weatherwatch-U.K.
Satellite Ground Station
RAE Lasham
Lasham Airfield ALTON, Hants. GU34 5SH.

POST SCRIPT

Weatherwatch has recently been advised of a problem on METEOSAT-3 involving the electronically despun antenna. An extract from first analysis of the problem is given below:

"The anomaly is a hole" in the radiation pattern of the Electrically Despun Antenna (EDA). The investigation this anomaly is continuing but the most likely cause is thought to be damage to one column of EDA dipoles. From a performance point of view this anomaly results in a slight drop in power for about one eight of each satellite revolution.

Detailed measurements have been made of the radiation pattern from P2 and it has been calculated that at the edge of the coverage zone and during this period of lower power, for SDUS there remains a positive margin, however for a PDUS link margin becomes very slightly negative and would result in a marginal increase in the bit error rate.

The effect could be cured by switching the WEFAX and high resolution digital image dissemination channels. It has already been decided to make this switch on the MOP satellites in conformity with recommendations from CGMS.
Users will be informed of any switch over well in advance.

Weatherwatch will be in contact with EUMETSAT regarding the current problem and all up dates will be passed on via the Weatherwatch Telephone Announcement service available on(025 683) 448 from 17.15 hrs to 08.45 hours Monday to Friday and all day Saturday and Sunday.

NOAA - H

The launch of NOAA-H is still sheduled for 24 September 1988.
Weatherwatch have a limited number of NOAA-H Information booklets available.

(Editors note: NOAA H was launched successfully and is now called NOAA 11 and is now operational, replacing NOAA 9).

Valerie Newell
WEATHERWATCH U.K.

# RIG RECEIVER EPROM TABLE 137-138 Mhz

These are the numbers contained in the control EPROM of the RIG receiver. If you have access to someone with an EPROM programmer, you can add new frequencies or make your own special scan pages, see your instruction sheet for page details.

| HEX | DEC | FREQ | HEX | DEC | FREQ | HEX | DEC | FREQ |
|---|---|---|---|---|---|---|---|---|
| 56 | 86 | 137.00 | 57 | 87 | 137.01 | 58 | 88 | 137.02 |
| 59 | 89 | 137.03 | 5A | 90 | 137.04 | 5B | 91 | 137.05 |
| 5C | 92 | 137.06 | 5D | 93 | 137.07 | 5E | 94 | 137.08 |
| 5F | 95 | 137.09 | 60 | 96 | 137.10 | 61 | 97 | 137.11 |
| 62 | 98 | 137.12 | 63 | 99 | 137.13 | 64 | 100 | 137.14 |
| 65 | 101 | 137.15 | 66 | 102 | 137.16 | 67 | 103 | 137.17 |
| 68 | 104 | 137.18 | 69 | 105 | 137.19 | 6A | 106 | 137.20 |
| 6B | 107 | 137.21 | 6C | 108 | 137.22 | 6D | 109 | 137.23 |
| 6E | 110 | 137.24 | 6F | 111 | 137.25 | 70 | 112 | 137.26 |
| 71 | 113 | 137.27 | 72 | 114 | 137.28 | 73 | 115 | 137.29 |
| 74 | 116 | 137.30 | 75 | 117 | 137.31 | 76 | 118 | 137.32 |
| 77 | 119 | 137.33 | 78 | 120 | 137.34 | 79 | 121 | 137.35 |
| 7A | 122 | 137.36 | 7B | 123 | 137.37 | 7C | 124 | 137.38 |
| 7D | 125 | 137.39 | 7E | 126 | 137.40 | 7F | 127 | 137.41 |
| 80 | 128 | 137.42 | 81 | 129 | 137.43 | 82 | 130 | 137.44 |
| 83 | 131 | 137.45 | 84 | 132 | 137.46 | 85 | 133 | 137.47 |
| 86 | 134 | 137.48 | 87 | 135 | 137.49 | 88 | 136 | 137.50 |
| 89 | 137 | 137.51 | 8A | 138 | 137.52 | 8B | 139 | 137.53 |
| 8C | 140 | 137.54 | 8D | 141 | 137.55 | 8E | 142 | 137.56 |
| 8F | 143 | 137.57 | 90 | 144 | 137.58 | 91 | 145 | 137.59 |
| 92 | 146 | 137.60 | 93 | 147 | 137.61 | 94 | 148 | 137.62 |
| 95 | 149 | 137.63 | 96 | 150 | 137.64 | 97 | 151 | 137.65 |
| 98 | 152 | 137.66 | 99 | 153 | 137.67 | 9A | 154 | 137.68 |
| 9B | 155 | 137.69 | 9C | 156 | 137.70 | 9D | 157 | 137.71 |
| 9E | 158 | 137.72 | 9F | 159 | 137.73 | A0 | 160 | 137.74 |
| A1 | 161 | 137.75 | A2 | 162 | 137.76 | A3 | 163 | 137.77 |
| A4 | 164 | 137.78 | A5 | 165 | 137.79 | A6 | 166 | 137.80 |
| A7 | 167 | 137.81 | A8 | 168 | 137.82 | A9 | 169 | 137.83 |
| AA | 170 | 137.84 | AB | 171 | 137.85 | AC | 172 | 137.86 |
| AD | 173 | 137.87 | AE | 174 | 137.88 | AF | 175 | 137.89 |
| B0 | 176 | 137.90 | B1 | 177 | 137.91 | B2 | 178 | 137.92 |
| B3 | 179 | 137.93 | B4 | 180 | 137.94 | B5 | 181 | 137.95 |
| B6 | 182 | 137.96 | B7 | 183 | 137.97 | B8 | 184 | 137.98 |
| B9 | 185 | 137.99 | BA | 186 | 138.00 | | | |

B.L.

# QUICK CALC FOR AOS, DIRECTION & ELEVATION FINDER

| NORTHBOUND SATELLITES | | | | : | SOUTHBOUND SATELLITES | | | |
|---|---|---|---|---|---|---|---|---|
| EQX | ADD MINS | AZ | EL | : | EQX | ADD MINS | AZ | EL |
| 330 | 9 | 131 | 1 | : | 170 | 29 | 020 | 0 |
| | 16 | 056 | 33 | : | | 36 | 091 | 37 |
| | 23 | 350 | 0 | : | | 43 | 171 | 2 |
| 340 | 8 | 151 | 1 | : | 180 | 29 | 016 | 2 |
| | 15 | 075 | 63 | : | | 36 | 118 | 75 |
| | 22 | 347 | 2 | : | | 43 | 192 | 2 |
| 350 | 7 | 171 | 0 | : | 190 | 28 | 012 | 0 |
| | 15 | 284 | 63 | : | | 35 | 308 | 55 |
| | 22 | 342 | 0 | : | | 42 | 212 | 3 |

AOS = acquisition of signal

To work out the overnight pass for NOAA 9, add 9 hours 36 mins and subtract 156 degrees, and for NOAA 10 evening pass, add 10 hours 8 minutes and 152 degrees.

Should the predictions run out then you can re-use the original set by looking at the pattern of eqx and times, for instance Noaa 9 and 10 repeat approximately every 10 days.

TIP. When the U.K. is likely to be covered in cloud, and you would like to know when the UK is in the picture, then add approx 13 1/2* mins to EQX (Northbound satellites), the top line of the picture will then be an eastish/westish line cutting through the Bay of Biscay about 1/2 way up, if you then stop the picture 4 mins 15 secs later, then somewhere on the screen will be the UK. (* about right for EQX at 345 which is a good UK overhead pass).

The above has been re-printed for the benefit of new members who do not have the Newsletters with this information in.

# POLARISATION OF SATELLITE SIGNALS

It is well known that low orbiting satellites use circular polarisation for the obvious reason that their attitude relative to any ground station must be continuously changing. If the signal was plane polarised the ground station antenna would have to be rotated about its axis to avoid the nulls which would occur when the polarisations of the sending and receiving antennae were mutually at right angles.

It is not so well known that polarisation of the signals are seldom truely circular. Mostly they are elliptical. Going back to basics, a circular polarised signal can be generated by radiating from two plane polarised antennae pointing in the same direction with their planes at right angles and with one signal quarter wave in advance or retard of the other.If crossed Yagis are on a common boom, the advance or retard may be obtained by sighting one Yagi a quarter wave further up or down the boom. Which is which is important as it determines the direction of rotation, clockwise or anti-clockwise. It is easy to change from one to the other. Reversing the connections to a dipole produces a 180° change equivalent to a half wave. Three quarters in advance is identical to one quarter in retard and v.v. The receiving antenna has, likewise, to be in the correct sense. Some may remember the fiasco when Goonhilly got it wrong on the occasion of the first transatlantic television via the satellite 'Early Bird' or was it 'Telstar'? Good signals over Europe but near zero in UK ! Incidentally for crossed Yagis on a common boom with no displacement, the quarter wave can be introduced as an extra quarter wave length of coax ( remembering the velocity factor of 0.8 or so) in one or other antenna lead. This enables the rotation to be switched fairly easily. The NOAA weather satellites are clockwise (RH) and the University of Surrey (UoSAT) satellites are anti-clockwise (LH).

When two crossed Yagis (or crossed dipoles or turnstiles) are pointing directly at each other then circular polarisation will be sent and received under theoretically ideal conditions. The antennae may be rotated about their common axis with no change in signal strength. Notice that the signals from the two planes are equal in strength from the symmetry of the set up. If one signal is not equal in strength to the other then the composite signal will no longer be circularly polarised but elliptical. The greater the difference the more elongated will be the ellipse until in the limit if one component becomes zero the other will be a plane polarised signal. This situation might occur if a satellite's crossed dipoles move so that the ground station is broadside to one dipole and end on to the other.

At the receiving end one would be unaware of this state as the crossed dipoles will still be receiving the plane component. In this situation a correctly orientated plane Yagi will give a signal and this will be better, theoretically, than the crossed Yagi. One can imagine that in the latter case one crossed Yagi is working but the other is connected in parallel acting as an unwanted load, presumably radiating some of the signal back into space !

# LATE NEWS

In the Kepler Element given elsewhere, our source of information does not give a figure for the Semi Major Axis. However David Bailey tells me that it may be computed from the other figures. In the predictions for the coming 3 months NOAA 9 has been replaced by NOAA 11. NOAA 9 is still operational and is left switched on for most of the time, except when the two satellites are close together and would interfere with one another, then NOAA 9 is switched off until the period of conflict is over. As there is insufficient space to include both sets of detailed orbit times I have obtained the Keplers for NOAA 9 these are given below. James Brown tells me that OKEAN has been in operation just recently giving radar images over the North Pole this is probably because of the Russian Icebreakers going to the aid of the Whales near Barrow Point. Les Currington tells me that the Chinese Weather Satellite FENG YUN has only been on for a few short occasions recently. I was told that if we requested that it was left on permanently, it might be. Excellent pictures were received for several days, but transmissions then became intermittent. The satellite is now showing signs of deep fading on early morning passes.
METEOR 3-2 Excellent pictures especially of Greenland. No I.R. has been received for several days now.
METEOR 2-16 No transmissions have been received for some time.

STOP PRESS ---- FENG YUN ---- Since mid October FENG YUN has started to tumble in space and would appear to be in major trouble. This has been confirmed by optical observations. It is still transmitting syncs and other test signals, but no valid visible or I.R. data. --- Kettering Group --- G. Perry.

KEPLERIAN ELEMENTS for NOAA 9

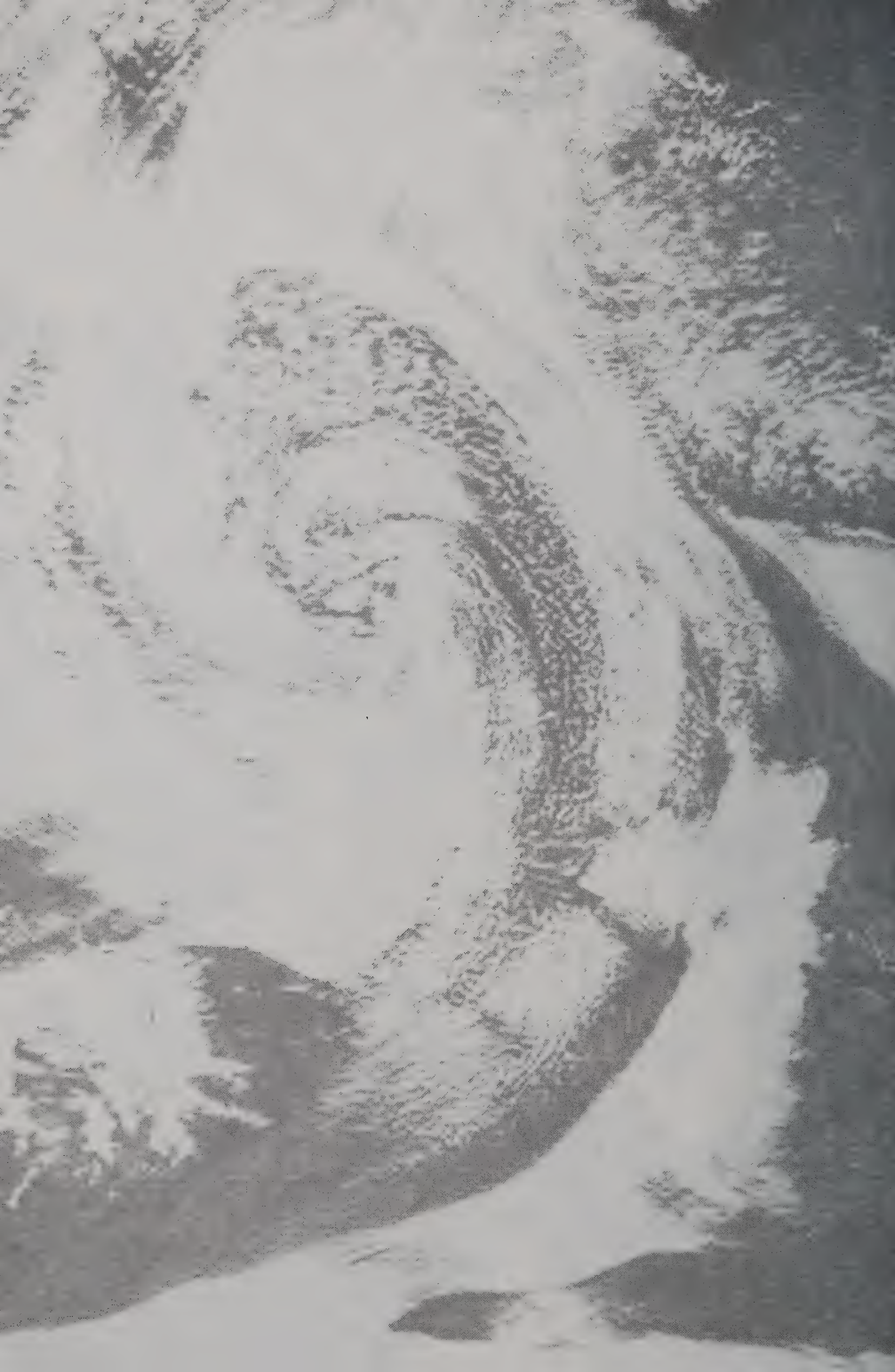
| | |
|---|---|
| EPOCH | 88290.8459143 |
| SEMI-MAJOR AXIS | 7236.91881 KILOMETERS |
| ECCENTRICITY | 0.000468 |
| INCLINATION | 99.11311 DEGREES |
| MEAN ANOMALY | 33.53903 DEGREES |
| ARGUMENT OF PERIGEE | 339.54666 DEGREES |
| R. A. OF ASCENDING NODE | 267.43853 DEGREES |
| ANOMALISTIC PERIOD | 102.00763 MINUTES |
| GHA OF ARIES AT EPOCH TIME | 330.0913 DEGREES |
| REVOLUTION NUMBER AT EPOCH TIME | 19812 |

NOAA '10 '  PERIOD  101.2732908584878  MINS
INCR  25.31990623474121  DEG

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/10 | 172 | 07:05 | 30/10 | 341 | 18:20 | 29/11 | 175 | 07:17 | 28/12 | 344 | 18:31 |
| 1/10 | 197 | 08:46 | 31/10 | 183 | 07:51 | 30/11 | 195 | 08:36 | 29/12 | 187 | 08:01 |
| 2/10 | 191 | 08:24 | 1/11 | 178 | 07:29 | 30/11 | 347 | 18:43 | 30/12 | 181 | 07:39 |
| 2/10 | 343 | 18:32 | 2/11 | 172 | 07:06 | 1/12 | 189 | 08:14 | 31/12 | 176 | 07:17 |
| 3/10 | 186 | 08:02 | 2/11 | 198 | 08:48 | 1/12 | 341 | 18:21 | 1/01 | 195 | 08:36 |
| 4/10 | 180 | 07:40 | 3/11 | 192 | 08:26 | 2/12 | 184 | 07:51 | 1/01 | 347 | 18:44 |
| 5/10 | 175 | 07:18 | 3/11 | 344 | 18:33 | 3/12 | 178 | 07:29 | 2/01 | 190 | 08:14 |
| 6/10 | 195 | 08:37 | 4/11 | 187 | 08:03 | 4/12 | 173 | 07:07 | 2/01 | 342 | 18:21 |
| 6/10 | 347 | 18:45 | 5/11 | 181 | 07:41 | 4/12 | 198 | 08:48 | 3/01 | 184 | 07:52 |
| 7/10 | 189 | 08:15 | 6/11 | 175 | 07:19 | 5/12 | 193 | 08:26 | 4/01 | 179 | 07:30 |
| 7/10 | 341 | 18:23 | 7/11 | 195 | 08:38 | 5/12 | 345 | 18:34 | 5/01 | 173 | 07:07 |
| 8/10 | 184 | 07:53 | 7/11 | 347 | 18:46 | 6/12 | 187 | 08:04 | 5/01 | 199 | 08:49 |
| 9/10 | 178 | 07:31 | 8/11 | 190 | 08:16 | 7/12 | 182 | 07:42 | 6/01 | 193 | 08:26 |
| 10/10 | 173 | 07:09 | 8/11 | 342 | 18:24 | 8/12 | 176 | 07:20 | 6/01 | 345 | 18:34 |
| 10/10 | 198 | 08:50 | 9/11 | 184 | 07:54 | 9/12 | 196 | 08:39 | 7/01 | 188 | 08:04 |
| 11/10 | 192 | 08:28 | 10/11 | 179 | 07:32 | 10/12 | 190 | 08:17 | 7/01 | 340 | 18:12 |
| 11/10 | 344 | 18:35 | 11/11 | 173 | 07:10 | 10/12 | 342 | 18:25 | 8/01 | 182 | 07:42 |
| 12/10 | 187 | 08:06 | 11/11 | 198 | 08:51 | 11/12 | 185 | 07:55 | 9/01 | 177 | 07:20 |
| 13/10 | 181 | 07:44 | 12/11 | 193 | 08:29 | 12/12 | 179 | 07:33 | 10/01 | 196 | 08:39 |
| 14/10 | 176 | 07:21 | 12/11 | 345 | 18:37 | 13/12 | 174 | 07:10 | 11/01 | 191 | 08:17 |
| 15/10 | 196 | 08:41 | 13/11 | 187 | 08:07 | 13/12 | 199 | 08:52 | 11/01 | 343 | 18:25 |
| 16/10 | 190 | 08:18 | 14/11 | 182 | 07:45 | 14/12 | 194 | 08:30 | 12/01 | 185 | 07:55 |
| 16/10 | 342 | 18:26 | 15/11 | 176 | 07:23 | 14/12 | 345 | 18:37 | 13/01 | 180 | 07:33 |
| 17/10 | 185 | 07:56 | 16/11 | 196 | 08:42 | 15/12 | 188 | 08:07 | 14/01 | 174 | 07:10 |
| 18/10 | 179 | 07:34 | 17/11 | 191 | 08:20 | 15/12 | 340 | 18:15 | 15/01 | 194 | 08:30 |
| 19/10 | 174 | 07:12 | 17/11 | 343 | 18:27 | 16/12 | 182 | 07:45 | 15/01 | 346 | 18:37 |
| 19/10 | 199 | 08:53 | 18/11 | 185 | 07:58 | 17/12 | 177 | 07:23 | 16/01 | 189 | 08:07 |
| 20/10 | 193 | 08:31 | 19/11 | 180 | 07:35 | 18/12 | 197 | 08:42 | 16/01 | 340 | 18:15 |
| 20/10 | 345 | 18:39 | 20/11 | 174 | 07:13 | 19/12 | 191 | 08:20 | 17/01 | 183 | 07:45 |
| 21/10 | 188 | 08:09 | 20/11 | 199 | 08:55 | 19/12 | 343 | 18:28 | 18/01 | 178 | 07:23 |
| 21/10 | 340 | 18:17 | 21/11 | 194 | 08:32 | 20/12 | 186 | 07:58 | 19/01 | 172 | 07:01 |
| 22/10 | 182 | 07:47 | 21/11 | 346 | 18:40 | 21/12 | 180 | 07:36 | 19/01 | 197 | 08:42 |
| 23/10 | 177 | 07:25 | 22/11 | 188 | 08:10 | 22/12 | 175 | 07:14 | 20/01 | 192 | 08:20 |
| 24/10 | 197 | 08:44 | 22/11 | 340 | 18:18 | 23/12 | 194 | 08:33 | 20/01 | 344 | 18:28 |
| 25/10 | 191 | 08:22 | 23/11 | 183 | 07:48 | 23/12 | 346 | 18:40 | 21/01 | 186 | 07:58 |
| 25/10 | 343 | 18:30 | 24/11 | 177 | 07:26 | 24/12 | 189 | 08:11 | 22/01 | 181 | 07:36 |
| 26/10 | 186 | 08:00 | 25/11 | 172 | 07:04 | 24/12 | 341 | 18:18 | 23/01 | 175 | 07:13 |
| 27/10 | 180 | 07:38 | 25/11 | 197 | 08:45 | 25/12 | 183 | 07:49 | 24/01 | 195 | 08:33 |
| 28/10 | 175 | 07:16 | 26/11 | 192 | 08:23 | 26/12 | 178 | 07:26 | 24/01 | 347 | 18:40 |
| 29/10 | 194 | 08:35 | 26/11 | 344 | 18:31 | 27/12 | 172 | 07:04 | 25/01 | 190 | 08:10 |
| 29/10 | 346 | 18:43 | 27/11 | 186 | 08:01 | 27/12 | 198 | 08:45 | 25/01 | 341 | 18:18 |
| 30/10 | 189 | 08:13 | 28/11 | 181 | 07:39 | 28/12 | 192 | 08:23 | 26/01 | 184 | 07:48 |

All morning passes are southbound, evening passes are northbound.

Frequency 137.50MHz. INCRement is degrees change per orbit.



NOAA '11'  PERIOD  102.1500015258789  MINS
INCR  25.52083749265385  DEG

NOTE. THESE PREDICTIONS ARE 'GUESSTIMATES' THE ACCURACY WILL BE AROUND
+/- 10 MINUTES +/- 10 DEGREES DUE BEING LAUNCHED 24/9/88

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 29/09 | 181 | 01:46 | 29/10 | 330 | 12:09 | 29/11 | 348 | 13:50 | 29/12 | 190 | 03:47 |
| 29/09 | 334 | 11:59 | 29/10 | 355 | 13:51 | 30/11 | 345 | 13:40 | 29/12 | 343 | 14:00 |
| 30/09 | 332 | 11:49 | 30/10 | 353 | 13:41 | 1/12 | 189 | 03:18 | 30/12 | 187 | 03:37 |
| 1/10 | 354 | 13:22 | 31/10 | 350 | 13:31 | 1/12 | 342 | 13:31 | 30/12 | 340 | 13:50 |
| 2/10 | 352 | 13:12 | 1/11 | 347 | 13:21 | 2/12 | 187 | 03:08 | 31/12 | 185 | 03:27 |
| 3/10 | 349 | 13:02 | 2/11 | 344 | 13:11 | 2/12 | 340 | 13:21 | 31/12 | 338 | 13:40 |
| 4/10 | 346 | 12:52 | 3/11 | 189 | 02:48 | 3/12 | 184 | 02:58 | 1/01 | 182 | 03:17 |
| 5/10 | 344 | 12:42 | 3/11 | 342 | 13:01 | 3/12 | 337 | 13:11 | 1/01 | 335 | 13:30 |
| 6/10 | 188 | 02:19 | 4/11 | 186 | 02:38 | 4/12 | 181 | 02:48 | 2/01 | 332 | 13:20 |
| 6/10 | 341 | 12:32 | 4/11 | 339 | 12:51 | 4/12 | 334 | 13:01 | 3/01 | 330 | 13:10 |
| 7/10 | 185 | 02:09 | 5/11 | 183 | 02:29 | 5/12 | 332 | 12:51 | 3/01 | 355 | 14:52 |
| 7/10 | 338 | 12:22 | 5/11 | 336 | 12:41 | 6/12 | 354 | 14:23 | 4/01 | 352 | 14:43 |
| 8/10 | 182 | 01:59 | 6/11 | 334 | 12:32 | 7/12 | 352 | 14:13 | 5/01 | 350 | 14:33 |
| 8/10 | 336 | 12:12 | 7/11 | 331 | 12:22 | 8/12 | 349 | 14:03 | 6/01 | 347 | 14:23 |
| 9/10 | 333 | 12:02 | 8/11 | 354 | 13:54 | 9/12 | 346 | 13:53 | 7/01 | 344 | 14:13 |
| 10/10 | 330 | 11:52 | 9/11 | 351 | 13:44 | 10/12 | 190 | 03:31 | 8/01 | 188 | 03:50 |
| 11/10 | 353 | 13:25 | 10/11 | 348 | 13:34 | 10/12 | 344 | 13:44 | 8/01 | 342 | 14:03 |
| 12/10 | 350 | 13:15 | 11/11 | 346 | 13:24 | 11/12 | 188 | 03:21 | 9/01 | 186 | 03:40 |
| 13/10 | 348 | 13:05 | 12/11 | 190 | 03:01 | 11/12 | 341 | 13:34 | 9/01 | 339 | 13:53 |
| 14/10 | 345 | 12:55 | 12/11 | 343 | 13:14 | 12/12 | 185 | 03:11 | 10/01 | 183 | 03:30 |
| 15/10 | 189 | 02:32 | 13/11 | 187 | 02:52 | 12/12 | 338 | 13:24 | 10/01 | 336 | 13:43 |
| 15/10 | 342 | 12:45 | 13/11 | 340 | 13:04 | 13/12 | 182 | 03:01 | 11/01 | 333 | 13:33 |
| 16/10 | 186 | 02:22 | 14/11 | 184 | 02:42 | 13/12 | 335 | 13:14 | 12/01 | 331 | 13:23 |
| 16/10 | 339 | 12:35 | 14/11 | 337 | 12:55 | 14/12 | 333 | 13:04 | 13/01 | 354 | 14:56 |
| 17/10 | 184 | 02:12 | 15/11 | 182 | 02:32 | 15/12 | 330 | 12:54 | 14/01 | 351 | 14:46 |
| 17/10 | 337 | 12:25 | 15/11 | 335 | 12:45 | 16/12 | 353 | 14:26 | 15/01 | 348 | 14:36 |
| 18/10 | 181 | 02:02 | 16/11 | 332 | 12:35 | 17/12 | 350 | 14:16 | 16/01 | 345 | 14:26 |
| 18/10 | 334 | 12:15 | 17/11 | 355 | 14:07 | 18/12 | 347 | 14:07 | 17/01 | 190 | 04:03 |
| 19/10 | 331 | 12:05 | 18/11 | 352 | 13:57 | 19/12 | 345 | 13:57 | 17/01 | 343 | 14:16 |
| 20/10 | 354 | 13:38 | 19/11 | 349 | 13:47 | 20/12 | 189 | 03:34 | 18/01 | 187 | 03:53 |
| 21/10 | 351 | 13:28 | 20/11 | 347 | 13:37 | 20/12 | 342 | 13:47 | 18/01 | 340 | 14:06 |
| 22/10 | 349 | 13:18 | 21/11 | 344 | 13:27 | 21/12 | 186 | 03:24 | 19/01 | 184 | 03:43 |
| 23/10 | 346 | 13:08 | 22/11 | 188 | 03:05 | 21/12 | 339 | 13:37 | 19/01 | 337 | 13:56 |
| 24/10 | 190 | 02:45 | 22/11 | 341 | 13:17 | 22/12 | 183 | 03:14 | 20/01 | 181 | 03:33 |
| 24/10 | 343 | 12:58 | 23/11 | 185 | 02:55 | 22/12 | 337 | 13:27 | 20/01 | 335 | 13:46 |
| 25/10 | 187 | 02:35 | 23/11 | 339 | 13:08 | 23/12 | 181 | 03:04 | 21/01 | 332 | 13:36 |
| 25/10 | 341 | 12:48 | 24/11 | 183 | 02:45 | 23/12 | 334 | 13:17 | 22/01 | 355 | 15:09 |
| 26/10 | 185 | 02:25 | 24/11 | 336 | 12:58 | 24/12 | 331 | 13:07 | 23/01 | 352 | 14:59 |
| 26/10 | 338 | 12:38 | 25/11 | 333 | 12:48 | 25/12 | 354 | 14:39 | 24/01 | 349 | 14:49 |
| 27/10 | 182 | 02:16 | 26/11 | 330 | 12:38 | 26/12 | 351 | 14:29 | 25/01 | 347 | 14:39 |
| 27/10 | 335 | 12:28 | 27/11 | 353 | 14:10 | 27/12 | 349 | 14:20 | 26/01 | 344 | 14:29 |
| 28/10 | 332 | 12:19 | 28/11 | 351 | 14:00 | 28/12 | 346 | 14:10 | 27/01 | 188 | 04:06 |

All morning passes are southbound, afternoon passes are northbound.
Frequency 137.62MHz. INCRement is degrees change per orbit.

# Reference orbits for Russian Satellites

These are the times of north-going equator crossings( in GMT) and longitudes (in degrees west) for three Russian satellites. They are given at weekly intervals together with the period and the change in longitude per orbit.

MET2-15

Period 104.087 minutes increment 26.18 degrees

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23AUG | 3:40 | 354 | 30AUG | 2:17 | 345 | 6SEP | 0:54 | 337 | 13SEP | 1:15 | 355 |
| 19SEP | 23:52 | 346 | 26SEP | 22:29 | 338 | 30CT | 21: 6 | 330 | 10OCT | 21:27 | 348 |
| 17OCT | 20: 4 | 339 | 24OCT | 18:41 | 331 | 31OCT | 19: 2 | 349 | 7NOV | 17:39 | 340 |
| 14NOV | 16:16 | 332 | 21NOV | 16:37 | 350 | 28NOV | 15:14 | 342 | | | |

MET2-16

Period 104.158 minutes increment 26.21 degrees

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23AUG | 6:51 | 339 | 30AUG | 5:30 | 331 | 6SEP | 5:53 | 349 | 13SEP | 4:32 | 341 |
| 20SEP | 3:11 | 333 | 27SEP | 3:34 | 351 | 4OCT | 2:12 | 343 | 11OCT | 0:51 | 335 |
| 18OCT | 1:14 | 354 | 24OCT | 23:53 | 346 | 31OCT | 22:32 | 338 | 7NOV | 21:11 | 330 |
| 14NOV | 21:33 | 348 | 21NOV | 20:12 | 340 | 28NOV | 18:51 | 332 | | | |

MET 2-17

Period 104.103 minutes increment 26.19 degrees

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23AUG | 11:36 | 349 | 30AUG | 10:10 | 340 | 6SEP | 8:43 | 330 | 13SEP | 9: 1 | 347 |
| 20SEP | 7:35 | 338 | 27SEP | 7:53 | 355 | 4OCT | 6:27 | 346 | 11OCT | 5: 1 | 337 |
| 18OCT | 5:19 | 354 | 25OCT | 3:53 | 345 | 1NOV | 2:26 | 335 | 8NOV | 2:45 | 352 |
| 15NOV | 1:19 | 343 | 21NOV | 23:53 | 334 | 29NOV | 0:11 | 351 | | | |

supplied by Dick Boardman.

It is possible to investigate all this experimentally by the simple expedient of having a hand held Yagi and portable receiver. I use a J-Beam 2 metre 5 element Yagi (Model LW5/2M). This is cheap,light and has a very useful gain (7 dbd). This still leaves a fairly broad beam of about 60°. It can be carried vertically through doors and will go inside the car for transport to demonstrations e.g. school playgrounds, field days. With a set of predictions (see Fig. 1), one can wave the Yagi in roughly the right part of the sky for AOS and track the pass to LOS. During the pass one can maximise the signal on the S-meter, if available, or minimise the background noise by moving the Yagi. When the elevation is low rotating the antenna about the axis plus or minus 90° results in quite big variations in signal strength. As the satellite gains altitude, the signal becomes more or less circularly polarised, such rotation having little or no effect. It is in this situation that crossed Yagis give a theoretical gain of 3 db over the plane Yagi but in practice the signal is so strong that the 5 elements provide all the gain needed for clean pictures. Used portable, the plane Yagi is clearly a better proposition. The crossed Yagi won't go in the car without dismantling nor will it go through a door without much manouevring. The advantage of gain is irrelevant in practice. However, at a fixed site, a rotator driven system would not display nulls on elliptical signals. The plane Yagi is obviously out on this score (unless one has a third rotator for rotating the boom about its axis !).

I used to receive one of the early geostationary satellites (ATS3) in the '70s on a plane Yagi. At the time it was stationed over the mouth of the Amazon which from London was, from memory, 255° at an elevation of 5 or 10°. At such low elevation this elliptical phenomenon was extremely marked. The Yagi was mounted on the mast on a loose fixing so that it could be rotated about the boom axis. Strings dangling from the ends of an element were pulled to rotate it to maximise the signal. Not the best practice but it worked !

Signals received on the battery operated receiver can be taped on a mains/battery recorder in the field and then played back into the frame store indoors to display. However one does not have the 2.4 kHz signal provided by the frame store for synchronisation purposes when out portable. This is normally recorded on the other channel of a stereo recorder. I have therefore built into my receiver a quartz oscillator divided down to 2.4 kHz and smoothed from square to sinusoidal for recording on the other channel(see Fig. 2). With cheap domestic stereo recorders (mine is a stereo radio/casette recorder/player mains/battery with no manual controls but with automatic level control) it is important to adjust the clock output level to be fairly close to that of the receiver audio output from the satellite signal. This is easily done with a double beam 'scope but very difficult to do empirically. Once set up synchronisation is perfect and, of course, is not lost during noise bursts, temporary loss of signal etc.

Taping weather satellites out of doors in this way has some spin off. It makes an ideal demonstration of the way a low orbiting satellite passes across the sky. It helps to relate orbital motion as calculated in a physics lesson with the real world. It also appears that operating the antenna at almost ground level one suffers much less terrestial QRN. After all, it is the worst site for a VHF antenna.

Finally making weather pictures in this way makes one more conscious of the local weather. It has been noted that if there are rain bearing clouds about precipitation occurs during the pass rather than before or after. This previously unrecorded phenomenon is offered as a project for future study by others. On one occasion I was to be found on top of a step ladder holding the Yagi over a wire fence in one hand and a brolly in the other.

John Osborne, G3HMO, June 1988.

FIG. 1 Shows a sample printout of G3HMO's BBC B program for satellite predictions. Any RIG member wanting a copy please send formatted disk (80 or 40 track) and postage to John (QTHR).

(a) is a table of passes for selected dates and (b) is the calculated Azimuth and Elevation for a selected pass.

Fig. 2 This is the circuit diagram of a quartz oscillator producing an accurate and stable 2.4 kHz sinusoidal signal for recording on the other track while receiving weather satellite picture signals.

The lowest crystal frequency which is a multiple of 2.4 kHz should be chosen to minimise the number of divider stages required. Fortunately G3HMO had collected a 12 kHz crystal some years ago so only a divide by 5 is needed here. The frequency can be trimmed with a small series capacitor; I set it against the 60 kHz signal from Rugby on a double beam 'scope.

The RC stages at the output end smooth the square wave from the chip to a nice rounded approximately sine wave for the output.

Fig 1:

```
This program, written by John Osborne,G3HMO, enables satellite orbits to be
predicted and azimuth and elevation for any pass to be calculated.
It may be copied by any amateur who mayfind it useful. Contact G3HMO (QTHR)
for help in update.

Program for low polar orbits e.g. UOSAT1/2 & NOAA 9/10. See lines 2520 onward
for sat.data and program GOTO 3300 for converting Kepler RAAN to EQX etc.
Also GOTO 3500 to convert  Mean Motion  to Nodal Period; Long. increment etc.

TO CONTINUE PRESS RETURN
```

Fig 1 contd.

```
MONTH?  6
DAY?  20
UoSAT 1 or 2 or NOAA 9 or 10 or MET2- 17 ENTER NUMBER  2
 FOR TABLE OF PASSES          PRESS T
 FOR AZ. EL. PRINT            PRESS P
      AND ENTER ORBIT NO.
 FOR AZ. EL. WITH OWN DATA    PRESS D
 FOR HELP entering new data   PRESS H

OPTIONS FOLLOW. FIRST USE ESCAPE          AND THEN :
To reRUN              use RED KEY 0
To enter new dates    use RED KEY 1
To change satellite   use RED KEY 2
For ALL orbits press RED KEY5: To cancel use 6 (Over Horizon Passes only)
 RED KEYS 3 to LIST,4 to halt printer,7 to ENTER new sat. data sub routine,8 for
 GMT, 9 for BST. NB set B% in line 470  to wake up in GMT/BST
```

Fig 1a

UOSAT2 DATA FROM 1/5/88 Orbit 22230

| DATE | ORBIT | BST | LONG |
|---|---|---|---|
| June '88 | | | |
| Monday 20 | | | |
| | 22964 | 858 | 155 |
| | 22965 | 1037 | 180 |
| | 22966 | 1216 | 204 |
| | 22971 | 2028 | 327 |
| | 22972 | 2207 | 352 |
| | 22973 | 2345 | 17 |
| Tuesday 21 | | | |
| | 22978 | 936 | 165 |
| | 22980 | 1115 | 189 |
| | 22981 | 1254 | 214 |
| | 22986 | 2106 | 337 |
| | 22987 | 2245 | 2 |

MORE ? Y/N

Fig 1b

UOSAT2 DATA FROM 1/5/88 Orbit 22230

| DATE | ORBIT | BST | LONG |
|---|---|---|---|
| 21/6/88 | 22980 | | |
| Tuesday | | 1115.5 | 189.7 |

PREDICTION FOR AZ. & EL. FOR UOSAT2
Ground Station LAT./LONG. 51/0

| BST | LAT. | LONG. | AZ. | EL. | RANGE |
|---|---|---|---|---|---|
| 1144 | 73 | 347 | 9 | 2 | 2800 |
| 1145 | 70 | 352 | 7 | 7 | 2400 |
| 1146 | 67 | 357 | 4 | 12 | 2009 |
| 1147 | 63 | 0 | 359 | 19 | 1635 |
| 1148 | 60 | 2 | 351 | 28 | 1294 |
| 1149 | 56 | 4 | 334 | 40 | 1024 |
| 1150 | 53 | 6 | 299 | 50 | 892 |
| 1151 | 49 | 8 | 257 | 44 | 957 |
| 1152 | 45 | 9 | 235 | 32 | 1188 |
| 1153 | 42 | 10 | 225 | 22 | 1510 |
| 1154 | 38 | 12 | 219 | 14 | 1875 |
| 1155 | 35 | 13 | 216 | 8 | 2261 |
| 1156 | 31 | 14 | 213 | 4 | 2659 |
| 1157 | 27 | 15 | 211 | 0 | 3061 |

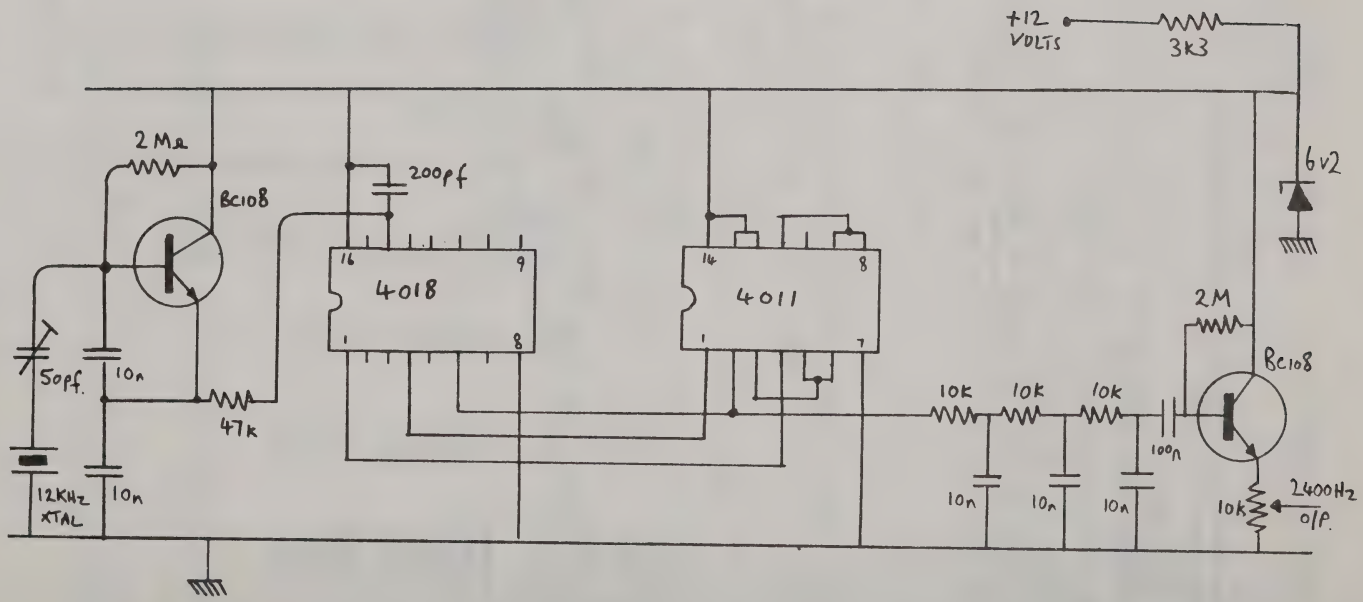



Fig 2 2400Hz Generator

## MEMBERS LETTERS:

Dear Phil,

Here is as promised a brief summary of the U.S. GOES Spacecraft Status. I hope it is of interest to some members. In January 1988, The National Oceanic and Space Atmospherics Administrator (NOAA) operated 3 Geostationary satellites over the United States,
These were :-

GOES 6 at 135 degrees WEST ( relative to the Greenwich Meridian )
GOES 5 at 108 degrees WEST ( " " " )
GOES 7 at 75 degrees WEST ( " " " )

However, GOES 6 has been plagued by hang ups which cause interruption of the imaging due to an ageing encoder lamp. The satellite is also over its five year design life. Also (like our Meteosat 2 ) it is almost out of station fuel.

So there has been a slight re-shuffle of satellite to prepare to take over control when GOES 6 fails completely. As of the 25th of March 1988 the new positions look like this

GOES 6 at 135 degrees WEST
GOES 7 at 75 degrees WEST
GOES 5 at 65 degrees WEST

Both GOES 6 and GOES 7 are used as VAS (Primary High Resolution Imaging) satellites. GOES 5 however is now used in WEFAX and Data Collection Service (DCS) Satellites. On the failure of GOES 6, GOES 7 will be moved into a new position to take over as:-

A. The West Imaging Spacecraft
B. The winter storm season spacecraft at 108 degrees WEST
C. The Atlantic Hurricane Season Spacecraft at 90 degrees WEST

GOES 5 will CONTINUE TO TRANSMIT WEFAX IMAGES FROM 65 degrees WEST and will also assume VAS operation for the EASTERN U.S. of America.

This means most users of secondary WEFAX transmissions from METEOSAT in the United Kingdom will be able to receive relayed WEFAX images from the satellite GOES 5 at 65 degrees WEST. At the time of writing GOES 5 was relaying images taken from both GOES 6 of the PACIFIC BASIN and Western United States, and GOES 7 images of the EASTERN United States. Not only are images from Geostationary satellites relayed, but a number of NOAA 9 visual and Infra red images are included in the schedule.

RECEPTION OF GOES 5 in the U.K.

1 The WEFAX transmission frequency is 1691 MHz. i.e. Meteosat primary frequency/C-TOT and D-TOT transmissions channel.

2 The signal is VERTICALLY POLARISED viewed from the U.K.

3 The signal power is approx 1.5 db stronger that Meteosat.

4 For most of the U.K. you will find the satellite at a compass heading of 270 degrees (nearly due west)

5 The elevation is approx 10 degrees over the horizon.

6 Transmissions are regular from 0600 to 1120 GMT, and from 2000 to 2205 GMT in between transmissions are spasmodic and the carrier is often turned off.

7 A copy has been included of the broadcast schedule and can be found on pages 40 through 43.

8 Reception results please to the editor.

Bob Sansoni, G4MWR.

Dear Phil

I hope this letter may help any reader using the Maplin Receiver and suffering from the dreaded paging interference. My receiver performed well at first but since paging transmitters locally were fired up any frequency above 137.62 became totally unusable and even frequencies below this were only usable if the satellite pass gave a very strong input as 'birdies' were audible right across the band.

After reading of the Dartcom mods to their receiver I decided to examine the passband of mine. Tests were not necessary as I found that of the three ceramic filters used in the design, only one was of the 50KHz 'scan' type. The other two were FM receiver types and had a passband of at least 200KHz at the 6db points. I took the easy way out initially and replaced all three filters with 50KHz types. The result had to be heard to be believed! The receiver was now usable right across the band with only the odd birdy audible and these were too weak to cause any problems. (These were later removed altogether with a Band Pass filter on the input to the receiver).

I obtained my ceramic filters type SFA10.7MF from Bonex as they were able to supply them all with the same centre frequency (Blue dot).

Now for a cry for help from me! My four picture mod. is the G4RAK (Chris Hornby) design. All frames load ok but when I page through them, pages 1 and 3 become split, that is part of the bottom half of the picture has repositioned itself at the top. Pages 2 and 4 are usually allright. If I use film mode the store completely forgets which page is which and the switching between pages is not clean. Any suggestions?

Trevor J Cartwright G8EVD

Dear Phil

Firstly, thank you for the latest newsletter from RIG. Thank you also for the letter included with the newsletter reminding me that I had not tried out the YU3UMV frame store!

Secondly, I will give you a brief summary of my interest in satellites and what is happening in West Wales. Over the years I have always had an interest in satellites having listened and

worked the various amateur satellites. Being a CDT teacher at Lampeter Comprehensive school in the county of Dyfed, I became involved in the 'Satellites in Education project' run by Annette Temple. Over the past few years I have taught various aspects of satellite technology to many of the pupils in the school but I am looking forward to the introduction of a new innovation next term.

Starting in September I am taking part in a pilot scheme to introduce Satellite Technology into the 6th form.. The students will be taught using Supported Self Study material which is being prepared at the moment. This material links up most of the subject areas within a school and looks promising. The equipment that they will use to receive the data from the satellites will be the Dartcom System for Meteosat and NOAA using the Nimbus computer with hard disc. The 6th form will soon fill that up HI! This system is really superb as Lawrence Harris stated in his article in the last newsletter. They will also be using the Unilab equipment for both NOAA and UOSAT. I will keep you informed of any development and if I get time I will write an article for the newsletter.

Finally, thank you for such an interesting newsletter. I will certainly be experimenting with the yagi designs for Meteosat.

73 de

Allan J Jones (GW4VPX)

Dear Phil

I'd like to enlarge on Bob Sansoni's letter (RIG, June '88) about the GOES geostationary spacecraft.

The GOES EAST station is currently occupied by the satellite GOES 5. This craft used to be the GOES CENTRAL satellite, but has been shifted from it's old position of 108 degs. W. to 65 degs. W. - consequently within our range. The old GOES EAST satellite (GOES 7) remains on station at 75 degs. W. until the imminent failure of the GOES WEST satellite (GOES 6). currently at 135 degs. W. When GOES 6 fails, GOES 7 will become the GOES CENTRAL satellite and will be shifted to 98 degs. W. during the summer months and Atlantic hurricane season. During the winter storm season, GOES 7 is further shifted to 108 degs. W. It's really not as confusing as it seems - honest!

GOES EAST (5) transmits it's own images, and also re-transmits images and wefax gleaned from GOES 7 on 1691MHz (Channel 2 on

Meteosat), and NOT 1694.5MHz (sorry, Bob). I enclose a copy of the NOAA dissemination schedule for GOES EAST - (see next page) what immediately springs to mind is the vast amount of wefax scheduling there is. Only around 50% of transmission time is dedicated to 'pictures'! Also, the timetable is far less reliable than Meteosat, as a scheduled transmission is often several minutes late.

Bobs quite right about the Polar Orbiters - they are retransmitted and in a photo-mosaic built up of several passes of both Northern and Southern hemispheres - even Australia is shown.

As regards lining up the dish, I urge anyone currently receiving Meteosat to have a go, or even invest in a second dish and converter, as I have done - it's well worth the effort. For those wanting to try, the look angles are thus: Azimuth 246 degs., elevation 5 degs. (co-ordinates for the Southern U.K.>) Obviously, the elevation is almost horizontal, so it would benefit to get some height for the dish and a reasonably obstacle-free trajectory. My dish is 10ft. from the ground, and despite a church tower being in the way at a few hundred yards, I get good results, though a pre-amp is essential at the dish, the signal being considerably weaker than Meteosat 2.

I've been receiving good quality signals for some weeks now from GOES 5, and the pictures generally are every bit as good as those from Meteosat 2, although, for some reason - which I assume to be atmospheric, reception is poor prior to 11 a.m. or thereabouts on most days, though it steadily improves as the day wears on.

I hope this sheds a little more light on the subject.

Chris Kaley

Dear Phil 6 July

I am a new recruit to remote imaging and RIG and I would like to congratulate you on your most interesting and informative newsletter. Thanks also to Des for his letter of welcome.

In view of the anguish expressed in the newsletters about the paging transmitter interference I wonder if my experiences might be of interest/use?:-

I recently bought, second-hand, a YU3 framestore, MSR20 receiver, pre-amp and crossed dipoles (inverted V Type). Demonstrated working!

....contd on page 44

## GOES - EAST
## BROADCAST SCHEDULE
Effective March 24, 1988 (0000Z)
(Revised March 1st, 1988)

| CHART | TIME(Z) | PRODUCTS | VALID AREA |
|---|---|---|---|
| GE01 | 0005 | NOAA-9 (Q) 10E - 60W VIS 150W - 130E MERC IR | |
| GE02 | 0020 | NOAA-9 (N) 10E - 80W POLAR DIR, 100E - 10E NH POLAR DIR | |
| GE03 | 0030 | NOAA-9 (R) 100E - 10E SH POLAR VIS, 10E - 80W SH POLAR DIR | |
| GE04 | 0050 | GOES-E 0001Z NE/SE QUADS IR | |
| GE05 | 0105 | NOAA-9 (P) 170W - 100E NH/SH POLAR NIR | |
| GE06 | 0120 | GOES-E 0001Z NW/SW QUADS IR | |
| GE07 | 0135 | GOES-W 0045Z NW/SW QUADS IR | |
| GE08 | 0150 | GOES-E 0001Z W/E TROPICAL IR | |
| GE09 | 0205 | GOES-W 0045Z NE/SE QUADS IR | |
| GE10 | 0220 | GOES-E 0001Z NW/SW QUADS VIS | |
| W064 | 0250 | SIG WEATHER PROG FL250 - 600 | VT12Z NT-24 EU-6 |
| GE11 | 0302 | ICE CHART - NORTHERN LIMIT (PART 1) | |
| GE12 | 0312 | ICE CHART - NORTHERN LIMIT (PART 2) | |
| | 0400 | ECLIPSE (0400Z - 0600Z) | |
| GE13 | 0405 | GOES-E 0300Z W/E TROPICAL VIS | |
| GE14 | 0420 | GOES-E 0300Z NW/SW QUADS IR | |
| GE15 | 0435 | GOES-E 0300Z NE/SE QUADS IR | |
| GE16 | 0450 | GOES-E 0300Z W/E TROPICAL IR | |
| GE17 | 0600 | NOAA-9 (A) 80W - 170W NH/SH POLAR VIS | |
| GE18 | 0615 | NOAA-9 (B) 100E - 10E NH/SH POLAR NIR | |
| GE19 | 0630 | NOAA-9 (C) 100W - 170W, 40W - 110W MERC VIS | |
| GE20 | 0645 | NOAA-9 (D) 80E - 10E, 140E - 70E MERC NIR | |
| GE21 | 0700 | NOAA-9 (S) 80W - 170W NH POLAR DIR | |
| GE22 | 0715 | NOAA-9 (T) SOUTH POLE DIR, 80W - 170W SH POLAR DIR | |
| GE23 | 0730 | GOES-E 0600Z NW/SW QUADS IR | |
| GE24 | 0745 | GOES-E 0600Z NE/SE QUADS IR | |
| GE25 | 0800 | GOES-E 0600Z W/E TROPICAL IR | |
| W014 | 0835 | 24HR 250 HEIGHT/ISOTACHS | PN26 |
| W015 | 0840 | 24HR 250 HEIGHT/ISOTACHS | NT21 |
| W016 | 0845 | 24HR TROP PRESSURE/VWS | PN26 |
| W017 | 0850 | 24HR TROP PRESSURE/VWS | NT21 |
| W018 | 0855 | 24HR 300 STREAM/ISOTACHS | PS-2 |
| W019 | 0900 | 24HR 300 STREAM/ISOTACHS | SA-8 |
| W020 | 0905 | 24HR 200 STREAM/ISOTACHS | PS-2 |
| W021 | 0910 | 24HR 200 STREAM/ISOTACHS | SA-8 |
| W022 | 0915 | 24HR 500 STREAM/ISOTACHS | PS-2 |
| W023 | 0920 | 24HR 500 STREAM/ISOTACHS | SA-8 |
| W010 | 0925 | 24HR 850 HEIGHT/ISOTACHS | PN26 |
| W011 | 0930 | 24HR 850 HEIGHT/ISOTACHS | NT21 |
| W012 | 0935 | 24HR 700 HEIGHT/ISOTACHS | PN26 |
| W013 | 0940 | 24HR 700 HEIGHT/ISOTACHS | NT21 |
| W100 | 0945 | 00Z MSL PRES/1000-500 THK | PN26 |
| W101 | 0950 | 00Z MSL PRES/1000-500 THK | NT21 |
| W102 | 1000 | 24HR MSL PRES/1000-500 THK | PN26 |
| W103 | 1005 | 24HR MSL PRES/1000-500 THK | NT21 |
| W104 | 1010 | 48HR MSL PRES/1000-500 THK | PN26 |
| W105 | 1015 | 48HR MSL PRES/1000-500 THK | NT21 |
| GE26 | 1020 | GOES-E 0900Z NW/SW QUADS IR | |
| GE27 | 1035 | GOES-E 0900Z NE/SE QUADS IR | |
| GE28 | 1050 | GOES-E 0900Z W/E TROPICAL IR | |

| CHART | TIME(Z) | PRODUCTS | VALID AREA |
|---|---|---|---|
| | 1100 | RESERVED | |
| | 1110 | RESERVED | |
| GE29 | 1115 | TBUS NOAA-9 | |
| GE30 | 1120 | OPERATIONAL MESSAGE | |
| GE31 | 1250 | GOES-E 1200Z NE/SE QUADS IR | |
| GE32 | 1320 | GOES-E 1200Z NW/SW QUADS IR | |
| GE33 | 1335 | GOES-W 1245Z NW/SW QUADS IR | |
| GE34 | 1350 | GOES-E 1200Z W/E TROPICAL IR | |
| GE35 | 1405 | GOES-W 1245 NE/SE QUADS IR | |
| W066 | 1420 | SIG WEATHER PROG FL250 - 600 | VT00Z NT-24 EU-6 |
| GE36 | 1430 | RESERVED (TBUS) | |
| GE37 | 1435 | GOES-W 1245Z W/E TROPICAL IR | |
| GE38 | 1450 | NOAA-9 (G) 10E - 80W NH/SH POLAR NIR | |
| GE39 | 1535 | GOES-E 1500Z NE/SE QUADS IR | |
| GE40 | 1550 | GOES-E 1500Z NW/SW QUADS IR | |
| GE41 | 1605 | NOAA-9 (E) 170W - 100E NH/SH POLAR VIS | |
| GE42 | 1620 | GOES-E 1500Z NE/SE QUADS VIS | |
| GE43 | 1635 | GOES-E 1500Z NW/SW QUADS VIS | |
| GE44 | 1650 | GOES-E 1500Z W/E TROPICAL IR | |
| GE45 | 1705 | GOES-E 1500Z W/E TROPICAL VIS | |
| GE46 | 1720 | NOAA-9 (F) 170W - 100E NH POLAR DIR, 100E - 10E NH POL VIS | |
| GE47 | 1730 | GOES-W 1545Z NE/SE QUADS IR | |
| GE48 | 1740 | GOES-W 1545Z W/E TROPICAL IR | |
| GE49 | 1835 | GOES-W 1545Z NW/SW QUADS IR | |
| GE50 | 1850 | GOES-E 1800Z NE/SE QUADS IR | |
| GE51 | 1905 | GOES-E 1800Z NW/SW QUADS IR | |
| GE52 | 1920 | NOAA-9 (H) 170W - 120E MERC VIS, 20E - 50W MERC NIR | |
| GE53 | 1940 | TBUS NOAA-10 | |
| GE54 | 1950 | NOAA-9 (J) 80W - 170W NH/SH POLAR NIR | |
| GE55 | 2005 | GOES-E 1800Z W/E TROPICAL IR | |
| W054 | 2020 | 24HR 250 HEIGHT/ISOTACHS | PN26 |
| W055 | 2025 | 24HR 250 HEIGHT/ISOTACHS | NT21 |
| W056 | 2030 | 24HR TROP PRESSURE/VWS | PN26 |
| W057 | 2035 | 24HR TROP PRESSURE/VWS | NT21 |
| W058 | 2040 | 24HR 300 STREAM/ISOTACHS | PS-2 |
| W059 | 2045 | 24HR 300 STREAM/ISOTACHS | SA-8 |
| W060 | 2050 | 24HR 200 STREAM/ISOTACHS | PS-2 |
| W061 | 2055 | 24HR 200 STREAM/ISOTACHS | SA-8 |
| W062 | 2100 | 24HR 500 STREAM/ISOTACHS | PS-2 |
| W063 | 2105 | 24HR 500 STREAM/ISOTACHS | SA-8 |
| W050 | 2110 | 24HR 850 HEIGHT/ISOTACHS | PN26 |
| W051 | 2115 | 24HR 850 HEIGHT/ISOTACHS | NT21 |
| W052 | 2120 | 24HR 700 HEIGHT/ISOTACHS | PN26 |
| W053 | 2125 | 24HR 700 HEIGHT/ISOTACHS | NT21 |
| W150 | 2130 | 00Z MSL PRES/1000-500 THK | PN26 |
| W151 | 2135 | 00Z MSL PRES/1000-500 THK | NT21 |
| W152 | 2140 | 24HR MSL PRES/1000-500 THK | PN26 |
| W153 | 2145 | 24HR MSL PRES/1000-500 THK | NT21 |
| W154 | 2150 | 48HR MSL PRES/1000-500 THK | PN26 |
| W155 | 2155 | 48HR MSL PRES/1000-500 THK | NT21 |
| GE56 | 2205 | GOES-E 2100Z NE/SE QUADS IR | |

| CHART | TIME(Z) | PRODUCTS | VALID AREA |
|---|---|---|---|
| GE57 | 2220 | GOES-E 2100Z NW/SW QUADS IR | |
| GE58 | 2235 | GOES-W 2115Z NW/SW QUADS VIS | |
| GE59 | 2250 | GOES-E 2100Z W/E TROPICAL IR | |
| GE60 | 2305 | GOES-W 2115Z NE/SE QUADS IR | |
| GE61 | 2320 | NOAA-9 (M) 10E - 80W NH/SH POLAR VIS | |
| GE62 | 2335 | NOAA-9 (K) 130E - 60E MERC VIS, 70E - 00W MERC VIS | |
| GE63 | 2350 | NOAA-9 (I) 170W - 100E, 100E - 10E SH POLAR DIR | |

| PN-26 | | PS-2 | NT-21 | | SA-8 |
|---|---|---|---|---|---|
| 21N/169W | 87N/10E | 70W TO 150W | 73N/155W | 30N/4E | 0 TO 80W |
| 1S/1 | 17N/78W | 26N TO 48S | 14N/89W | 1N/43W | 26N TO 48S |

| NT-24 | | EU-6 | | |
|---|---|---|---|---|
| 28N/145W | 78N/135E | 78N/135E | 25N/54.5E | |
| 2.5N/83.5W | | 16.5N/45W | 16.5N/45W | 1.5N/5W |

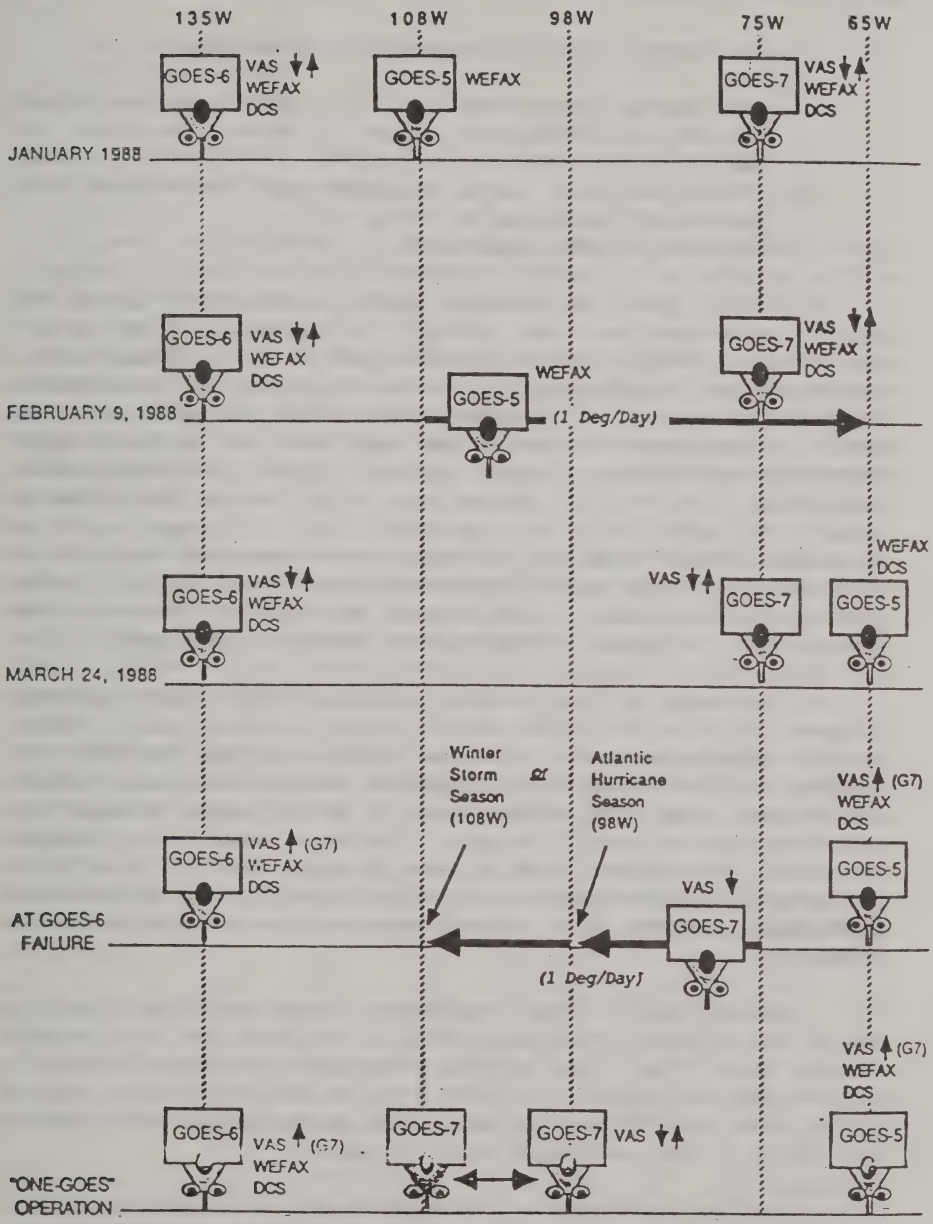
## Celestial Bulletin Board
## - change of number

T S Kelso, who runs the Celestial Bulletin board has recently moved to Ohio, and so the Bulletin board telephone number has changed. It is now, from the UK, 0101 513 427 0647; 8 data bits, 1 stop bit, no parity, 300/1200/2400 baud, Bell tones.

Ther is a vast amount of information onthe board, and his Kepler elements are updated about twice a week.

Information provided by David Bailey.

# PROPOSED GOES SPACECRAFT OPERATIONS SCENARIO



Imagine my dismay when I got it home and found that I could hardly get 10 seconds of picture before it was wiped out by interference of one sort or another.

The interference could be grouped into three types:-

(a) Four paging transmitters on 137.97 +/-5kHz and some others higher in frequency which I didn't examine in detail.
(b) Police and other radio telephone type traffic with occasional 2m amateur activity.
(c) Ignition or pulse type noise.

Of these, group (a) was the worst problem with two of the paging transmitters very very strong. On inspection of the circuit diagram of the MSR20 I didn't like the look of 2 r.f. stages with a pre-amp as well, too much gain ahead of the mixer. So I removed the 2 r.f. stages and put the antenna directly into the mixer on a link turn. Interference is now quite weak but so is the signal! Reinstate the pre-amp; signal up but so is the interference. Compromise, I put the r.f. stages back in but reduced their gain by reducing the gate 2 bias volts on each. The r.f. stages could now be peaked without breaking into oscillation and group (b) gave no more trouble. Five damping resistors across the five r.f. turned circuits were removed in an attempt to improve the front and selectivity. It helped a little but no dramatic improvement.

At this stage an inspiration - I used my FT757 general coverage receiver to listen on 10.7MHz at the output of the IF amp. (Taped in with a 10pF capacitor). There were the satellites, in the clear, no QRM! Well, well, so that proved that the problem was not cross-mod in the mixer and neither was it dirty paging transmitters spreading over the satellite band. Tuning up above 11MHz revealed the paging transmitters 40dB or more stronger than the satellites. Two ceramic filters obviously were not providing enough stop-band attenuation and the poor old 6601FM sub-system was being pulled sideways!

I removed the IF stage completely. On a small PCB I built a new IF amp of about 25dB gain using 3 off BC184 and five ceramic filters (yes, five, I was getting desperate) I had the filters in the junk box and anyway I couldn't find in the catalogues a crystal filter wider than 30kHz. The small PCB was hooked in on the end of two pieces of coax and bingo! group (a) gone.

I sat back watched the pretty pictures and celebrated with a small Glenfiddich. (WARNING) Don't use 5 off 50kHz ceramic filters unless you can afford to but lots and select for a reasonable match

of centre frequencies. Two which I obtained from Maplin were offset by about 20kHz). The five which I used had the following approximate band widths:-

1) & 2) 250kHz
3) & 4) 150kHz
5) 50kHz

However, 4 off CIRKIT 150kHz filters might be a good idea, together with the single 50kHz one.

I was still bothered, a bit, by (c) and although NOAA 9 would give me pictures down to GIBRALTAR it seemed to be slow to capture the discriminator and was prone to fading.

So another bit of PCB and a CA3089 out of the junk-box were pressed into service to replace the 6601 FM sub-system. Much stronger audio, no more trouble from (c) and pictures now received from well down the Moroccan coast and the Sahara on up to Arctic circle. (I have a hill to the north so not so good in that direction).

I haven't used the mute output on the CA3089 for auto operation yet. I have been told that the CA3189 is improved in this respect. Also, I haven't used the AFC output; but it is a thought that with a mod, to the local oscillator the AFC could be used to track doppler. Then a 30kHz filter would perhaps be tolerable even though the specified downlink r.f. is 35kHz wide.

So there you are, a long saga and the receiver now occupies about 1 square yard of my shack with a festoon of wires and coax. But it works! Dare I tidy it up and put it in a box or will Murphy strike?

Perhaps I should have written this in the form of an article and called it "How I turned my MSR20 into a weather satellite receiver!".

All the best, keep up the good work.

MALCOLM A PURVES, G4OFF

And a further letter from Malcom:-

Dear Phil, 12 August

I know that publication for the next issue is upon you so this is written in haste.

I would like to start off with a little diatribe -I must say that I have been a little surprised at the vitriol which has been directed towards the operators of paging transmitters by the users of weather satellite receivers with only two ceramic filters as the main IF stage. Professional telecommunications engineers are known to shudder and reach for medicinal brandy if "ceramic filter" is whispered within a radius 50 yards ! The only saving grace of a ceramic is its price and size.

My previous letter to you was written just a few days before the arrival of NL13 ( congratulations on a big job well done ) In view of the recommendation in NL 13 to fit extra ceramic filters to the IF. I think some further comments in addition to the brief warning that I gave in my previous letter might be of some help to others fitting their own extra filters.

The two 50kHz filters which I bought from the local Maplin shop were offset by about 20kHz in there centre frequencies. If I had used these in my receiver the IF bandwidth would have been only about 30 kHz. See the sketch in Fig 1, see page 48. I do not know if this was a typical case or extremely unlucky and I an not about to find out by buying any more at #1.00 ago. However if it was typical then imagine the effect on the IF response of the addition of a third filter if it happened to be off in the other direction by only 5 or 10kHz.

OK. some would say that 30kHz is tolerable if we can get rid of the QRM and a quiet reasonable picture could still be obtained at this bandwidth.

However, maybe I am a bit of a purist, but I think that if the satellite is giving us 35kHz or thereabouts of RF we should do our best to get it all! Anyway there is still the allowance of 5 or 6kHz to be made for doppler shift if you don't want to have to keep returning. So all considered it would be a pity if we had to reduce our IF bandwidth below 50kHz. Now for those lucky enough to own a Dartcom Rx there is no problem. Back to Dartcom who have the facilities to select a matching extra filter. However for those forced to go it alone what can they do? Consider that there are two primary design features of an IF filter which concern us here.(1) The miniaturisation of the receiver noise bandwidth in order to maximise the S/N ratio at the input to the discriminator. (2) The reduction of adjacent channel and out of band interference.

A single 50kHz unit with a typical stop band attenuation of the order of 20db is quite satisfactory for the noise bandwidth problem. Also adjacent channel interference from other Wx. Sats. is quite happily taken care of by the existing receiver configurations.

Right then, on to the nitty gritty, what do we do about you know who up above 138MHz! In Fig 2, see page 48, is a simplified sketch of a worst case simulation of a wanted signal on 137.85 at fc the IF centre frequency and an interferer higher up at 138.07 or thereabouts. The response A is for a 50kHz filter, B is for ( one half ) a MURATA 110 kHz and C is for a CIRKIT 150 kHz filter.

So, within reason, we could stack up almost as many say 50 kHz filters as we like ( to get rid of the paging transmitters plus one 50 kHz filter to define the noise bandwidth. ( Taking care of course to provide sufficient gain in the IF amplifier to account for the insertion loss of all the filters, typically 6db per unit.)

I would therefore suggest that for those without the test gear to select suitable 50 kHz filters it would be prudent to try the wider bandwidth filters.

There is another reason to be cautious about using several 50 kHz filters. The phase response and group delay outside the central 20 or 30 kHz is not pretty! Anyone got the test gear to see if this would be significant?

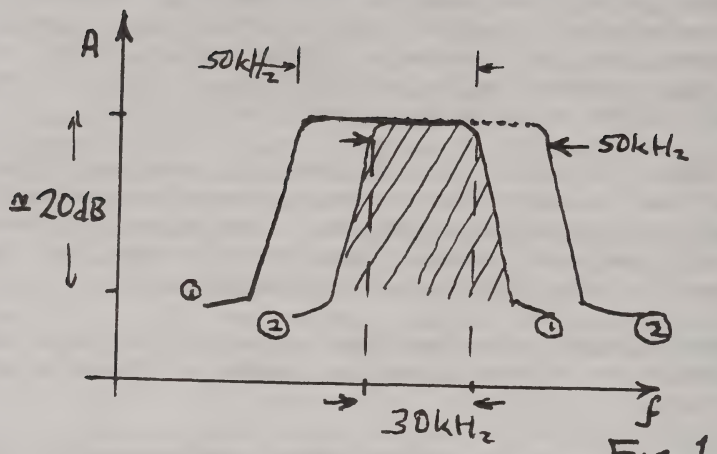
In my case four wider filters of dubious parentage (ie out of the junk box) plus one 50 kHz cured my problems. With only three of the wider filters fitted there was a slight interference.
For guidance and comparison I have line of sight paging transmitters at a distance of about 4, 12, and 13 miles. This information was given to me by a very helpful RACAL technical chap and radio amateur who is keen to be of assistance and you Phil will have know doubt have heard of him by now.

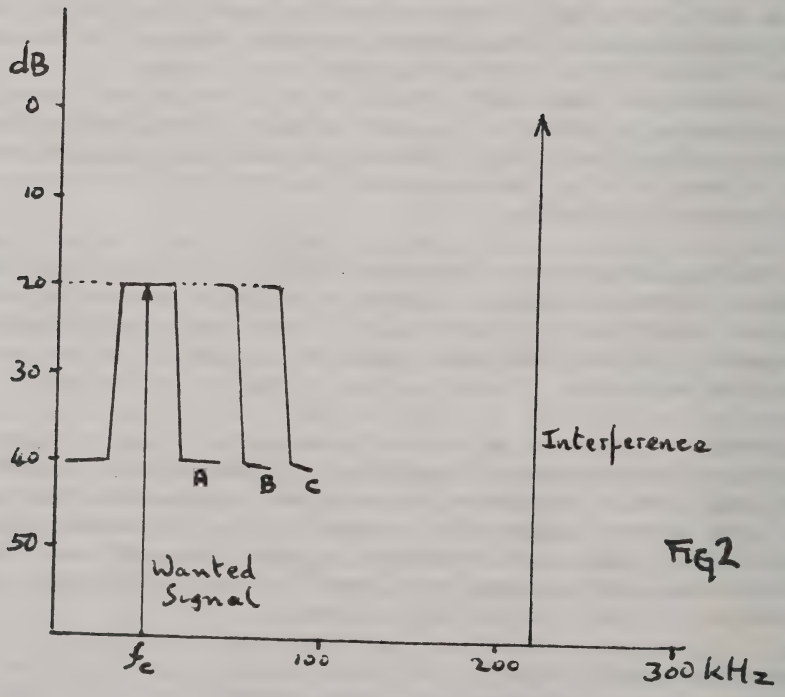
By the way, these transmitters are 100w ERP only. Now considering that on 2 meters we expect to work alongside other amateurs using several kw ERP quite often a lot closer both in distance and frequency, it really does cast doubt on the quality of our weather satellite receivers.

If anyone is troubled by other " odd noises " which cannot be attributed to the paging transmitters it might be worth remembering that under some circumstances the stop band attenuation " far out " (ie 1 MHz or more anyway ) of a ceramic filter IF. stages can rise back to only -10dB or so. Therefore it might be useful to include a conventional double tuned band pass LC stage, with the usual screening, to limit the far out response.

Thats all, my wrist hurt!
73's may all your interferers be little ones!

Malcolm A. Purves


A
50kHz
≈20dB
50kHz
30kHz
f
Fig 1


dB
0
10
20
30
40
50
A
B
C
Interference
Wanted Signal
fc
100
200
300 kHz
Fig2

Dear Phil,

Would you kindly send me a membership form for the Remote Imaging Group (s.a.e. enclosed).

Could you possibly put me in touch with any RIG member who has successfully modified a 3M fax transceiver Model 9160 for weather satellite images, direct, or after retransmission by Bracknell on HF, or who has used this machine for amateur fax?

I was given a 5 year old machine that had failed, and have repaired its switched mode power supply and other faults. This particular model should be very handy for amateur fax, as it keeps an automatic log of calls, with time, date, identification, duration etc., that would meet licence requirements.

It is supposed to recognise and adapt to CCITT group 2 or group 3 with automatic speed adjustment, but on feeding it with signals from the HF bands it will only give an "error" signal.

Any contacts you could suggest would be much appreciated.

Michael Ball G6EQX
1, Manor Drive, Chesham Bois, Amersham, BUCKS HP6 5NH

Dear Phil,

It was interesting to see the similarity in the two aerial designs published in the magazine. In my article I mentioned the fact that I still had some noise on my pictures at the time of writing and I was going to try a pre-amp. This I have done and it had no effect. Finding this puzzling I investigated further and found that if I shortened the co-ax cable between the LMW down converter and the receiver the pictures became perfect. Very simply the converter was not capable of driving 20 feet of cable. The insertion of a buffer amplifier has now solved the problem. As an item of interest to others the buffer amplifier lowered the magnitude of another problem I have had with the LMW converter. Very simply this converter should be sold with a government health warning with the label reading as follows - "Depending on area of use this product may attract yellow vans with rotating aerials on top". The local oscillator source for this converter on a separate board generates 776.75 MHz as one frequency for injection into the converter at a power of 5 milliwatts.

This is multiplied by two in the converter to give the local oscillator frequency.

Both the frequencies for the two Meteosat channels are in the TV band, luckily for me not in my locality. This signal at 776.75 leaks out of the 137MHz port of the converter at a high enough level on the co-ax cable to the 137 mhz receiver to squash a portable TV flat for as far away as I could carry it down the street. The insertion of the buffer amplifier cut this down by enough to make this tolerable as it acted as an in line filter. My only final comment relative to this converter is relative to the way the crystal oscillators drift with temperature. I think that this is relevant to other converters e.g. the Maplin one as well. I solved this problem with the heated controller circuit that is published in a lot of the amateur radio books that uses a 741 op amp, a transistor as a temperature sensor and a transistor as a heater attached to the crystals this worked perfectly and my converter stays on frequency even when the sun is shining directly on it. Hope comments have been of use.

BRANDON JONES G4ISQ

Dear Phil

I am enclosing a copy of the transmission schedule ( see page 36) for GOES-E which I obtained some time ago. I have been looking at its numerous formats and also processing its picture data using the Dartcom acquisition system in conjunction with my home-built dish.

Using the Weatherwatch phone-line I found out that GOES-E was visible from the South-west and so I moved my dish to point west and found the signal within a few minutes.

Firstly for those searching for it the transmission frequency is that for channel 2 on Meteosat so switch over first - you will not hear anything on channel 1. Then by pointing the dish within a degree or so of the western horizon you should pick the signal up without problems. In fact my dish has to point between a tree and a house. You should then adjust the polarisation of the dipole feed for maximum strength and I found it to be near vertical, due to the relative orientation of GOES-E.

The signal that I receive is stronger than that from Meteosat! GOES-E transmits a series of formats including the following:-

1. It's own pictures of the NW, NE, SW and SE quadrants in both infra-red and visible . The infra-red ones are transmitted several times during a 24 hour period; the visible ones only once.

2. It's own pictures of the tropical east and west both visible and infra-red, but only the latter on a regular basis.

3. Retransmitted pictures collected from GOES-W are included and of the same type as for GOES-E e.g. NW quadrants etc. These pictures are exceptionally interesting since they provide unparalleled pictures of the west coast of America and also of the Pacific Ocean. One really has to stand back in amazement at these pictures! Using the Dartcom colour synthesiser I have been able to emphasise the ocean temperature variations in various shades of blue.

4. Retransmitted pictures collected from NOAA-9 are also broadcast and these include a variety of most interesting formats; stored pictures of both north and south poles are transmitted in both visible and infra-red. I am archiving some of these for later reference to seasonal variations. Additionally, Mercator projections of the polar regions are broadcast!

5. TBUS data for both NOAA 9 and 10 are broadcast.

6. Isotach data for various levels are broadcast, together with various Mean Sea Level pressure data charts, leading to the accumulation of a vast amount of meteorological data.

7. Finally, an ice chart containing the major locations and sizes of icebergs is included!

The one thing lacking is the whole disc formats as transmitted by Meteosat on channel 2. Although perhaps not as scientifically useful they do provide a dramatic perspective of planet earth.

With the addition of GOES-E pictures I find that the only regions of the earth outside my field of view is that of the Far East. Perhaps at some time that may be covered?

Lawrence Harris

Dear Phil

Due to the confusion over my address since moving to North Wales, the Membership Survey reached me before Newsletter 11 and I stupidly failed to listen out before responding that I do not suffer interference with satellite broadcasting. Since my last burst of activity during late January somebody has started to radiate a signal which appears as a one second silence (pure carrier?) after a five second quiescent period.

Naturally this affects weak NOAA signals, but the effect is limited to the areas beyond Sicily and Iceland on overhead passes. I have not observed any modulation of these signals, nor can I measure the frequency although it affects 137.62 MHz more than 137.50 Mhz. See below for station details.

STATION PROFILE:

Please note that I am not, nor ever have been an amateur radio practitioner so excuse my lapses!.

My first receiver was a Cirkit 'UoSat' design, which was the first time I had built any radio equipment despite being active professionally in computer construction and repair. It performed well enough to copy both UoSats and is occasionally used today. Having built a decoder for telemetry I was frustrated by the weak signal and local interference, and particularly motor-bikes. Having obtained a ready-built receiver from Timestep together with a preamp and crossed dipole antenna I was instantly hooked on the strong APT broadcasts and set about producing pictures. I was director of a computer repair firm at the time and we built a prototype graphics controller/frame store for the Computer Automation Naked Mini series of 16 bit systems. Soon the antenna was installed in the loft (where it remains due to my dislike of ladders and weatherproofing) and high resolution pictures were the order of the day. I purchased the Timestep decoder and soon had it connected to the minicomputer with a custom 8-bit parallel interface. Good snaps would yield a picture 600 pixels x 850 lines and potential customers were always impressed by weather demos. Due to this very impressive hardware my outlook on contemporary systems has been permanently clouded, a situation made worse by visiting colleagues at the Open University in Milton Keynes to see their Landsat image processing.

Now that I have relinquished my position with that company and moved to Wales the search for hardware has begun again. A framestore is most desirable, despite the attractions of instant hard-copy devices such as photofax, but to be really useful should be part of a computer system for processing and archiving the good images. The image quality of some 'educational' systems is remarkably poor, and I don't want to buy an obsolete BBC micro just to attach a device such as the Martelec unit which looks good in specification. In the meantime I have to put up with what I have got, which is a home-built Z80 CP/M system (SC84 - ex Wireless World) with an Oki Microline 182 printer. I have enclosed a sample printout because I was very interested by the article in Newsletter 12 which touched on most of the problems which I have experienced. The results speak for themselves - certainly it is possible to achieve results equal to four-colour screen systems.

Roger Barker should be congratulated for his work, which is not as easily dismissed as he thinks. My printout is produced by detecting line-sync and taking 320 samples from the frame which follows. Each pixel is reduced to a four bit grey level, which is then mapped onto 7 greys defined as a 3 dot x 2 line block printed as a double-density graphic map at a resolution of 120 dots per inch. The printing process is slow, so several succeeding frames are lost, but this does not show at this resolution unless you look for frame markers. I am willing to circulate a copy of the listings, but the software is not robust enough for distribution.

As for the future, I am determined to press ahead with Meteosat reception since the APT service has been so effectively ruined by interference problems. Until now I felt that the display should come first, but things are moving fast as the chips drop in price so maybe I should set up my dish instead. I am interested to know whether I will get any results if the dish is installed indoors, since the winds here (overlooking Conwy Bay and Anglesey) are fierce at times. Also, the house faces South and I am very aware of the Goonhilly Downs syndrome. Does anybody have experience of the Maplin system, based upon a more traditional antenna? I note that review articles are not as common as they used to be. Finally, is there a source of a decoding system for AVHRR data from NOAA. If a system could be constructed at a reasonable cost then the receiver hardware would be worth-while.

Jonathan Wilkins

Dear Mr Seaford,

You may recall that I wrote to you a few weeks ago regarding difficulties in finding a supplier of the P.A. Electronics FAX decoder as reviewed in Newsletter 13.

I have solved the problem at last, and for your interest if anyone else should ask, the ONLY person dealing with the decoder is Mr D.L. Bird, 22, Beech Avenue, Melksham Wilts, SN12 6JP.

Regards
Peter Stonebridge.

Dear Phil, 19 Aug

Further to my recent phone call, I have now got my Frame Store problems more or less sorted out and I will pass on my experiences for all other weather enthusiasts.

First of all I have carried out the filter modifications to the Dartcom receiver with 100% success ( as published in newsletter 13.) I originally fitted a 10.7 MHz filter with a 300kHz bandwidth normally used for domestic F M receivers and when I eventually fitted the 50kHz bandwidth filter I noticed no difference!
I live only 3 miles away from Beacon Hill transmitter and had problems with interference every few seconds. But I can definitely recommend the mod.

Regarding the Frame Store, after replacing a couple of Signetics 4029's with Motorola versions made everything seemed ok. I was receiving good cloud pictures, but days were going by, I didn't seem to recognise any land.
Eventually after much staring at the screen I realised the pictures were negative e.g. whites black and blacks white.
Looking back through the back copies of the newsletter I came across the wiring circuit for all the boards described by K. Hamlyn in newsletter No 6. and saw the picture invert I.C., which I had knowledge of. With the help of my colleague Martin, at work, I used a 4001 and started receiving excellent pictures. Just one problem, then I noticed that Italy was kicking the wrong way. Again with the help of Martin, who understands logic circuitry more than I do.

I changed the 33K resistor feeding the 2 pin 10 of IC's I205 to a 3.3 k, this promptly reversed my picture and now I couldn't wish for better pictures.

I have carried out the x 4 zoom mod by G4RAK (newsletter No5 ) and am using an aerial on the design of G3WLM (newsletter No4).
There is just one problem left on my Frame Store which I hope to sort out in the near future. I will let you know the results. Just out of interest the problem is the black lines scrolling up or down the screen varying in spacing, depending on which zoom position is used and pulsing to the clock frequency. They do not interfere with the memory and disappear when the clock is switched off.

I have gone on long enough, thanks for introducing me to such an interesting hobby.

Your's Faithfully
John Hickin.
G3PXL.

John Hicken continues with a follow up letter:

Dear Phil, 2 Sept

Further to my recent letter regarding my own trials and tribulations with the frame store. I can now proudly say I have got it all working.

As I described in my previous letter, the final problem I had with the frame store, was thin black lines scrolling down the picture beating in time with the clock frequency, but not interfering with the memory or display.
They disappeared when the clock was stopped. I traced the fault to IC 217 74LS04 by disconnecting the 1K5 resistor from pin 8. I received a perfectly clean picture without affecting the scrolling.

Just out of interest I tried another chip to no avail. I hope this piece of information may be of interest to mother readers.

By the time this letter is published I will have assembled a S.H.F. station to receive Meteosat. If I have any problems I will let you know,

All the best to you and your readers,

John Hicken G3PXL.

---

FOR SALE:
Commodore Pet Home Computer complete with screen and two tape decks. 32k of memory, BASIC in ROM. #40.00 Buyer Collects.

R.M. Boardman, 76 Gravel Lane, Hemel Hempstead, HERTS, HP1 1SA.
Tel. 0442 52596

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Dear Phil,

Please could you ask the members of the Remote Imaging Group, via your newsletter, if anyone would have recordings, photo's, etc of the weather sats output for the evening of 15/7/88 to early morning 16/7/88. As you may have heard EA8BEX & EA8BML were heard over a period of nearly six hours in Ireland from 21.00 GMT on two metres!

This propagation was tropo and led to the first EA8/GI contact and a new region 1 tropo dx record of 3065 kms. Ths satellite pics on Friday evenings (15/7/88) weather forecast showed very clearly two deep lows either side of Ireland and a long 'pan handle' of clear sky coming from the high to the south of Ireland running diagonally across Ireland (NE to SW). If anyone can help me get a copy of these pics I can be contacted on Antrim 67948 evenings & Wk/ends or at the address below.

Many thanks, Brian Sheepwash, GI4KIS.

204, Donors Crescent, Antrim, Northern Ireland, BT41 1JB

---

Members Ad:

I propose to offer a 25% discount to any members who may be visiting the island at any time if they require a Taxi. All they have to do is call me on either number and I shall meet them at the ferry or hovercraft terminal.

# REWARD

## $40,000

*For information leading to Amber's safe return.*

# MISSING

**SINCE JUNE 3rd**

# AMBER SWARTZ-GARCIA

**White Female**
**Height: 4 ft. tall**
**Weight: 62 lbs.**
**Hair: Blonde (short)**
**Eyes: Blue**

**Birthdate: 8-19-80**
**7 years old**
**Upper right front tooth missing**
**SEVERELY HEARING IMPAIRED**
**Suffers from Migraine Headaches**

**Last seen wearing a white short-sleeve shirt with pictures of sunglasses all over it, purple corduroy pants, white "L.A. Gear" tennis shoes with pink shoelaces. May have a leather jump rope with wooden handles in her possession. Last seen on June 3, 1988 in Pinole, California.**

---

If you have any information about this child, please call:

## PINOLE POLICE (415) 724-8950
## HOT LINE (415) 724-9066
## NATIONWIDE 800-541-0777

*AMBER SWARTZ-GARCIA Foundation for Missing Children • P.O. Box 565 • Pinole, California 94564*

Meteosat Downconverter - Fully described in RIG 8:-

a). Assembled and tested module in tin plate box:-
£129.69 + £1.50 p&p.

b). Complete mounted in weather proof box:-
£157.96 + £3.00 p&p.
Waterproof power and channel change connector £10.00 extra if required, but note these functions can all be done via the coaxial downlead.

The RIG Receiver module is proving to be very popular with members and is still available from the secretary. The full specification was printed in RIG 5, but briefly the spec. is:

136 - 138 MHz Scanning receiver module
Sensitivity 0.2uV for 12 db SINAD at 10 kHz deviation
IF bandwidth 50 kHz
Audio tailoring specially designed for weather sats.
* NEW * Additional filtering to deal with new paging systems.

Built and aligned PCB together with
LED channel display module, Molex PCB connectors
and optionally, a full frequency LCD readout.

Basic module with channel display £112.55 + £1.50 p&p
as above with additional LCD frequency display
£151.57 + £1.50 p&p
Prices includes packing and recorded delivery.
Cheques for above items payable to "DARTCOM".

---

The RIG VHF preamp also available includes a bandpass filter and is ideal for mast-head mounting. The spec. was printed in RIG 7. It is
available from the secretary as a built and aligned PCB measuring 85mm by 33mm ( 3 5/16 x 1 15/16 inches).

Module including first class post £13.37

Other items available by post:

A-D module for complete control of grey levels on the framestore £18.86

Cheques payable to "Remote Imaging Group" please

Anybody requiring PCBs should contact the secretary, G8XTW.

## WHERE TO OBTAIN A RIG DISH and FEED HORN:

The RIG has had specially made, some 1 metre spun aluminium dishes and some compatible horn feed assemblies. These are intended to form the basis of an aerial system to receive signals form Meteosat II.

The cost of the dishes and feed horns has been kept to an absolute minimum. So they will not be available by any form of carriage as packing such an item would be impractical. So UK members only, sorry. They are only available to members who may only collect them from the dispatch points below or from rallies we attend in the future.

When using the dispatch points please use the telephone numbers given to reserve your dish and when collecting please pay by cheque payable to the "Remote Imaging Group".

1 Metre Spun aluminium dish for Meteosat - New thicker ver £38.00
Tubular feed horn with tripod mount for dish above £33.73

Bedfordshire

The Editor/secretary, see front cover

Oxfordshire

Dermot, G8SIN, Tel. 0865 61797
22 Ramsey Road, Headington, Oxford.

Lincolnshire

Henry, G3REH, Chairman, see front cover

Devon

Dave, G4XOU, Tel 0822 613343
15 Milton Crescent, Down Park, Tavistock, Devon.

Sussex

Des, Membership Sec. Tel. 0273 813103

Manchester

John (J.M.) Horrocks G8GTP, Tel 061 766 6269
"Fairview", 17 Wood Grove, Whitefield, Manchester.

Hertfordshire

Les, G8LOK, see front cover

Birmingham

Colin Hall - see front cover.

# spacetech

AUTHORISED DISTRIBUTORS NRSC NATIONAL REMOTE SENSING CENTRE

L. E. Hornby, 21 West Wools, Portland, Dorset DT5 2EA. Tel: 0305 822753

## SPACETECH NEWS

You might have seen our new **Weather Satellite Podule** for the Acorn Archimedes at one of the rallies. The results are spectacular. Already some folks have gone out to buy an Archimedes just to run this one application..need we say more! £259.95 (rig members £249.95).Phone for full description. Demo disc £5 refundable..copy and return!
Having trouble with Meteosat P2? Our new stand-alone **Meteosat receiver** is a superb no-compromise trouble free design ..even gives noise free pics from GOES-E with a 0.9m dish! £299.95. Ask for list of our other RF and decoding equipment. We can supply the YU framestore built and cased.

| BOOKS: | Memb | Non-memb |
|---|---|---|
| **Weather Satellite Reception:** Chris Hornby. A guide to get you started,Aimed at the beginner,but useful reference. | 5.50 | 5.95 |
| **Sourcebook of Remote Sensing:** A guide to products, utilities etc. V.useful information source for enthusiast | 14.25 | 15.00 |
| **Guide to Facsimile Stations:** Klingenfuss. A wealth of info not only on FAX but NOAA,Meteosat etc. | 12.00 | 12.00 |
| **Guide to Utility Stations:** Klingenfuss.For dedicated SWLs | 19.00 | 19.00 |
| **Britain from Space:**Colour Landsat Atlas of British Isles. | 11.95 | 12.50 |
| **Images of the World:** Satellite image atlas | 13.30 | 13.95 |
| **Posters and Teaching Materials.** (All posters in colour) | | |
| The Third Planet. Meteosat Whole Disc. 400x600 | 1.75 | 1.75 |
| British Isles.Landsat natural colour. 480x710 | 2.00 | 2.00 |
| Europe by Satellite.NOAA HRPT. Superb! 590x780 | 2.50 | 2.50 |
| London. Landsat colour. Thematic mapper 30m resolution. | 4.50 | 4.95 |
| Satellite Images (1 large,6 small charts +booklet) | 4.95 | 4.95 |
| Satpack 1 & 2:NOAA HRPT images with overlays, interpretation and worked examples.From Royal Met. Society. (per pack) | 2.40 | 2.40 |

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**Small:** 9.25 (9.75) small framed in real wood 24.00 (25.75)
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Subjects include: whole disc, NOAA AVHRR Europe,UK cloudy weather, Landsat: UK, Scotland, Ireland. GOES E whole disc, Phone/write for list
**NEW:** The October Hurricane, NOAA HRPT. large only. 18.50 (19.95)
**Videos:** All videos £51.75 or £10.00 hire (+£10.00 dep.+£1.00 P&P) Please phone for current stock..Ideal for winter club night!
**Slides:** Many available with books and sound cassettes. Please write or phone for latest list before your lecture or presentation.
**Equipment:** All equipment listed here free P&P.

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| **FAX1:** We know it reviewed badly in RIG,but for its application i.e. HF FAX weather maps, the resolution is EXCELLENT. Phone for detailed spec and copy of more favourable review! | 269.00 | 279.95 |
| **FAX1 + PSU + Printer** (Epson Compatible Copal SC1200) | 389.00 | 399.95 |
| **HF125** General coverage HF RX | 365.00 | 375.00 |
| Please phone us for your packet radio requirements.. e.g. PK232 with facsimile TRANSCEIVE (IBM,C64 s/w avail) | 259.95 | 269.95 |

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# weather satellite systems and kits

MSD20 METEOSAT DISH ASSEMBLY

A high quality, precision made aluminium dish and mount assembly, complete with dipole feed. The universal mount design enables it to be either pole, wall, or patio mounted. Used in conjunction with our MSC20 ultra low noise downconverter it is capable of superb results otherwise only achieved with larger dishes. Diameter 1m (requires no planning permission)

| | |
|---|---|
| Complete with mount & feed assy. | £139.73 |
| Next-day delivery & insurance | £18.00 |

---

MSC20 ULTRA LOW NOISE DOWNCONVERTER

The ultimate in low noise downconverters for the best possible, noise-free pictures. The MSC20 uses the latest GaSFET technology to achieve its incredibly low noise figure. The MSC20 is complete with temperature controlled Meteosat ch1 & ch2, and housed in a weatherproof ABS enclosure for masthead mounting.

| | |
|---|---|
| | £159.45 |
| Optional regulated 12v PSU | £13.80 |

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MSR20 VHF SATELLITE RECEIVER

A high-performance dual-conversion design optimised for low noise and high sensitivity. It incorporates audio mute, automatic tape-recorder siwtching, electronic channel selection, S-level and deviation metering as standard. Housed in a professional steel case, and complete with all leads etc.

Performance Summary:-

| | |
|---|---|
| RF Bandwidth (3dB) | 2.5MHz |
| IF Bandwidth (3dB) | 50KHz |
| 1st IF Frequency | 10.7MHz |
| 2nd IF Frequency | 455KHz |
| Image Rejection Ratio | >100dB |
| Sensitivity (12dB Q'ting) | 150nV |
| (fully Q'ting) | 600nV |
| Supply Voltage | 12v d.c. |

| | |
|---|---|
| Complete, cased receiver incl leads | £152.55 |
| Kit (excl. case, but incl. all off-board components, leads etc. | £78.25 |
| Module built, with off-board comps. | £96.75 |
| Finished Case with meters, l/speaker, all connectors, leads, knobs etc. | £41.60 |

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MSA20 CROSSED-DIPOLE AERIAL

A high-quality, well finished aerial designed specifically for weather satellite use. Comes complete with ground-plane radials, and now wth pre-wired phasing harness for even easier use!

| | |
|---|---|
| Standard Aerial | £30.76 |
| As above , but with integral preamp | £48.93 |

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MSS20 BBC BASED DECODER/SOFTWARE PACKAGE

Complete built and tested interface, designed for owners of Acorn model B, B+, and Master micros. This exceptional hardware/software package produces weather sat pictures as never before on a BBC. Host of excellent software features make this the best value system available anywhere, whether for educational or general interest usage.

Features include:-

- Zoom - x2, x4, x8
- Geyscale control for vis or I.R.
- User-defined colour palette
- North/South picture invert
- Printer dump (FX80 formats)

NOTE- The MSS20 system is capable of really excellent results, and should not be confused with other, inferior, BBC-based systems from elsewhere.

Send £3 for the demonstration disc and see for yourself.

£86.19

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* * * * NEW * * * * NEW * * * * NEW * * * *

ARCHIMEDES-BASED WEATHER SATELLITE SYSTEM

At the time of going to press, this new Spacetech system should be available. It comprises a podule for the Arch, and embodies many advanced features for picture manipulation and control. Full details available on request. Approx. price £250.

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MSG20 GRAPHSTORE - HI-RES FRAMESTORE

Graphstore is a powerful high-resolution framestore, with built-in graphics processor for unparalleled picture processing power. Basic operating mode gives two hi-res pictures of 512 x 512 x 128 grey levels. Alternate animation mode gives eight pictures of 256 x 256 x 128 grey levels.

Features:-

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- * Smooth XY Scrolling
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- * Post Reception Processing (PRP)
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- * Printer Dump Routine

Graphstore is a professionally-built system with extensive upgrade potential - usually in software. It is fully assembled, tested and cased, with its own internal PSU, all leads and manual, and software.

£399.91

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OTHER KITS AND BITS.....

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| MSK20 137MHz Preamplifier | - kit | £10.95 |
| | - built | £19.95 |
| YU3UMV Framestore * | - (64K) | £80.72 |
| | -(128K) | £94.97 |
| LOK Sync Board Kit | | £25.85 |

*Temporary price increase due to World memory shortage.

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